Railway Mechanical Engineer

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The past nine months have witnessed several radical developments in apprentice training in the mechanical departments of American railroads. In the first place, the marked tendency in recent years to place a higher value on the human element in industry and to improve the methods of personnel administration has been reflected in the larger interest that is being taken in the selection and training of the young men entering the railway mechanical department. This has stimulated a greater and more intelligent interest in the apprenticeship question and it is not surprising to find a number of graduates of the apprentice training department of the Santa Fe heading up similar departments on other roads. Meanwhile, the Santa Fe, through the holding of its annual apprentice instructors' conferences, and its annual apprentice conventions, has been doing much to improve still further its methods and practices.

Improvements in apprentice training

It is interesting to note that other roads which have adopted the Santa Fe methods in general, are departing from them in some particulars, better to meet different or changing conditions in their particular localities. There has been a tendency on the part of some of the leaders, also, to study more critically the methods of some of the more advanced educators. Results are being manifested in various ways, and on one railroad at least, psychological tests are being experimented with in a limited way in selecting and rating apprentices.

There has been a tendency on the part of some of the railroads to call upon outside agencies to a greater or less extent, to assist them in preparing material for, or in conducting the schoolroom or outside study required in conjunction with the shop training. A notable development in this respect during the past season is found in the cases of the Baltimore & Ohio and the Missouri Pacific, both of which roads have made somewhat similar arrangements in contracting for the educational material, the examination and grading of the papers, and a certain amount of supervision from an outside agency. The results of this practice will undoubtedly be watched closely by other railroads.

Another significant fact is that some of the improved apprenticeship training methods and courses have been inaugurated or stimulated because of an expression on the part of the workers for such improvements.

Undoubtedly, also, more attention is being given on many roads to checking up to determine whether the young men are as well qualified by temperament, personality and training as they should be for the particular tasks upon which they are engaged. In some cases this is due to the "Find Yourself Programs" of the Younger Railroad Men's Conferences.

There seems to be a pronounced feeling among the apprentice supervisors and instructors throughout the country that something should be done to bring them together at regular intervals to discuss their common problems and to benefit from each other's experiences. It has also been suggested that the railroads might make a very considerable saving if some of the more common methods and practices or tests could be standardized, and if time and energy could be saved by carrying on certain studies and experiments collectively, or under the direction of the group as a whole, rather than independently and without any correlation, as at present.

The Mechanical Division has had an apprentice committee functioning occasionally in the past and now has a set of recommended practices on apprenticeship as a result of such committee activities. Is the time not now ripe for gathering together those interested in apprenticeship problems under the direction of the Mechanical Division, or as a part of the program at one of its regular meetings, and possibly in connection with the presentation of the report of a selected committee which might be assigned to study and report upon apprentice training principles and progress.

In the year 1926, a total of 408 grinding machines of all kinds were purchased by 107 railroads representing 87 per cent of the total route mileage on this continent. While this substantial increase over the 291 grinders purchased during 1925 and the 240 purchased during 1924, demonstrates an increased healthy interest in grinding machines on the part of railroad shop men, the interest is really less than indicated by the figures because 44 per cent of the grinders purchased were floor grinders and, although counted in the total and performing a highly important function in railroad shops, can hardly be classed as major grinding machines, such as piston rod grinders, guide grinders, link grinders, internal grinders and car wheel grinders.

Grinding machines demonstrate merit

Still more extensive use of grinding machines by the railroads is desirable not only because this method of machining may safely be said to have revolutionized the automotive and other industries in the interest of greater efficiency, but because progressive railroads have themselves demonstrated over a period of years the great economy and effectiveness of this type of machine for many operations. Cylindrical grinders are used for truing piston rods, valve stems, crank pins, driving axles and trailer axle journals, car wheels, etc.; surface grinders for guides, exhaust bases, stoker engine plates, die blocks, shear blades, etc.; internal grinders for air compressor reverse gear and other cylinders, solid main rod back ends, valve motion bushings, air brake parts, etc.; car wheel grinders for both new and slid flat cast-iron and steel car wheels. Countless locomotive and car parts, now in service after having been trued and finished by grinding, present a striking testimonial to the effectiveness of the modern grinding machine.

Regarding grinding machines, the *Railway Mechani-*

cal Engineer said in June, 1922, "These machines are now made of sufficient capacity to finish locomotive and car parts from the rough stock. In the speed of production, accuracy and smoothness of finish, grinding machines are unsurpassed. They are particularly adapted also for the truing of worn parts. These worn parts are usually surface hardened to a rubbing or wire-drawing action and if a cutting tool were used to true the surface, a considerable cut would necessarily be taken to get under this hard shell. With the grinding, however, just enough material is taken off to true up the surface and, because little material is removed, there is a considerable saving of time required for the operation. . . . . There are still some shops which do not utilize grinders to the greatest advantage and either get along without them or else use old grinders, which, through lack of power and rigidity are entirely unsatisfactory compared to the modern machines, which are available. There is a big field for the more general introduction of grinding machines of various kinds and sizes for railroad work."

The above statement is just as true today as it was five years ago. Grinding has become practically the standard method of finishing piston rods, and surface grinders, particularly when equipped with magnetic chucks, effect great economies in set-up and finishing time on some jobs. Internal grinders are increasingly popular for finishing air compressor cylinders in which the more accurate and smooth surface gives increased compressor life and efficiency. Car wheel grinders have continued to demonstrate their value during the past year, although the question of complete versus partial grinding of the wheel circumference is in dispute among railroad men and recommendations against the latter practice have been made by the Mechanical Division Committee on Car Wheels.

The objection is sometimes still advanced that abrasive from grinding wheels adheres to ground metallic surfaces. This statement has been refuted by practical experience with grinding in both railroad and industrial service as well as by the most exacting scientific tests. Prejudice against the use of grinding machines on this account is unwarranted and should not be allowed to stand in the way of further substantial economies in shop operation and the improvement in bearing surfaces possible from the more extensive installation of grinding machines.

Refinement in machine tool design

Since the publication of the June, 1926, shop equipment number of the *Railway Mechanical Engineer*, the trend of machine tool design has been one of refinement rather than development. During the past few years, the builders have turned to motorizing all of their machine tools. This idea has so increased in popularity that practically every machine tool built today has motor drive, at least as optional equipment. In some cases, motor drive is standard and countershaft belt drive is special, while in others, motor drive only is furnished. Motors are applied not only to the larger units, but also to the smaller machines, such as small drills, pipe threaders, grinding machines, etc., requiring fractional horsepower motors. Motors are more and more being built into machine tools rather than "tacked on" as an afterthought. Accessibility, minimum utilization of space and protection are the three principal factors that determine the location of a motor on a machine.

The larger machine tools are being more completely motorized to speed up production. This is true on two different makes of boring mills which were described in these pages during the past year. These machines have been provided with power rapid traverse to the saddle, and the two tool spindles have individual motors.

Control is another important branch of development that has undergone considerable refinement. New models of machie tools prove that considerable thought has been given to ease of control and facility in chucking or feeding. Fast table movements on milling machines, treadle control of work-heads on grinders, push-button control, pneumatic and hydraulic chucks, and the bringing together of all control handles within easy reach of the operation all show this tendency. In addition, complete control mechanism has been placed on both sides of large planers and boring mills. This feature helps to speed up production.

Another tendency in refinement has been toward better bearings. Ball and roller bearings are being more and more employed. Having first been used successfully on intermediate shafts, their application is extending, and now they may be found on the main spindles of several machines.

Where improvements have been made over former models, it is usually found that the construction is more rigid and the range greater, so that heavier cuts can safely be taken at higher speeds. This is particularly true of the bed castings and cutter heads of planers, boring mills, slab milling machines and turret lathes.

An equally important improvement has been made in lubrication. Flood lubrication by pump or splash is the rule in the best machines. Many machines have been redesigned to secure a more efficient and a more centralized system of lubrication. Among such machines can be listed a car wheel lathe, an axle lathe and a quartering machine. Some builders have gone so far as to include oil filters in the lubricating systems. A type of oil filter for removing dirt and chips from the lubricant has been described in these pages during the past year.

Hydraulic feed is becoming popular for drilling equipment, especially with the multiple-spindle machines. Improvements in radial drilling machines include motor on the arm, roller bearings, central control from the head, power clamping, mechanical interlocks and traversing bases for boiler plate drilling.

At last three automatic chucking machines have been perfected in the past year. One of these is a vertical machine, fitted with automatic mechanical chucks, the other two being of the horizontal type, with air chucks. Development is shown in the design of grinding machines, including the wide-wheel machines used for straight in feed.

The fact that two each of portable pipe threading machines, drilling machines and universal wood workers have been described in these pages during the past year, indicates that the builders are fully aware of the necessity on some railroad work of bringing the machines to the job.

The principal development in wood-working machinery has been the refinement of the safety devices to protect both the operators and the work. In many cases these machines have been made proof against injury.

Many of the builders, realizing the tendency in railroad shops, to work to closer tolerances, have equipped their tools with vernier and micrometer attachments, especially on boring mills, milling machines and planers.

Generally speaking, the year has been one of steady improvement in detail rather than one of startling new inventions. There is a growing demand for machinery that conserves the strength and time of the operator. Whereas progress in any one direction has not been phenomenal or radical, however, there is hardly a type of machine on the market that has not been improved during the past year.

Car building contests

The annual car building contests that have been held for the past five years by the car department of the Delaware & Hudson, have been of considerable interest not only to railroad car department officers, but to car builders and manufacturers of car appliances as well, ever since the first contest was held in October, 1923. At that time such a car building contest was considered by many to be a "stunt" of little real practical value. This feeling was largely due to the fact that many thought the working conditions under which such a contest was conducted were made so ideal that the information obtained, such as time studies, etc., could be of little service in applying to everyday car shop methods of production. However, the car department officers of the Delaware & Hudson have been holding these contests each year, regardless of adverse criticism, and have evidently made them an established institution.

There is no doubt but that the location of the three principal division car repair points on the system has been a big factor in making these car building contests a success. Teams representing the Pennsylvania, Susquehanna and Saratoga divisions are chosen for each annual contest from the Carbondale, Pa., Oneonta, N. Y., and the Colonie and Green Island car shops, located near Albany, N. Y., respectively. Having three teams instead of two is naturally more of an incentive toward keen competition. The employees at the four car repair shops considered it an honor to represent their division on its team—and it is an honor. The members of each team are chosen according to their individual ability as a workman which places membership on a car building team on practically the same basis as that of a high school or college varsity football team. In other words, being on the division car building team is considered the sign of a master workman and is an award for ability shown in the car building trade during the past year. The psychological benefits are obvious.

A comparison of the time required for the various operations, as well as the total time for the five contests that have been held to date, reveal some interesting facts. To illustrate, the first contest was won by the Pennsylvania division, with a six-man team doing all the work in 7 hr. and 49 min., or a total of 46.9 man-hours. The fifth contest, held May 19, 1927, was won by the Saratoga division in 3 hr. and 6 min., with a team of 8 steel car repairers and 6 wood car repairers, making a total of 43.48 man-hours. The problem for the first contest was dismantling and rebuilding the superstructure, including trucks and draft gears, of a composite twin-hopper gondola of 85,000 lb. capacity. The fifth contest consisted of rebuilding the steel underframe, superstructure and trucks, assembling and applying the draft gears, couplers and brake rigging of the same type of car. A comparison of the time figures for these two contests shows that the total time required by the winners of the fifth contest was less than the time required by the winners of the first contest to complete the woodwork alone. Evidently the division teams must have done some studying and experimental work with the object of reducing the time to dismantle and rebuild this type of car. A new method for organizing the work and new devices must have been developed to reduce the time and labor required. In all probability, many of these devices can be used, or are now being used, in the shop. Perhaps the organization of the work or of the gang is applicable to current production.

It is in the preparation and training for the contest from which the real benefits are obtained. The contests provide an opportunity for trying out new ideas, which in the opinion of the foremen and workmen, have practical possibilities. It does not take a student of human relations or an expert car repair man to see that both the employees and the management of the car department are profiting by these annual car building contests.

Leadership training

The mechanical departments of many of the railroads have kept step with the more progressive industrial companies in this country in the growing recognition of the need for a higher type of leadership ability on the part of the officers and foremen. In both the June, 1925, and June, 1926, issues of the *Railway Mechanical Engineer* extensive surveys, or round-ups, were presented of what was being done in the mechanical departments of the various railroads as to foremanship or leadership training. The problem was approached on different railroads in various ways; indeed, the great variety of approaches and methods, all working toward the same general end, was extremely noticeable in both of the above-mentioned surveys.

The need for such training has become so generally recognized among railroad mechanical department officers, and the movement has been progressing at such a steady rate, that it was not thought advisable to present a detailed survey of the situation this year. It is not out of place, however, to discuss certain developments of more or less significance. In the first place, not a few of the leaders have become convinced that not only must active measures be taken to inform and coach the present officers and supervisors in the principles of leadership, but that we must look ahead and start preparing for the foremen and officers for the future, by giving greater attention to the selection of young men entering the service, and to their future education and training. Then, too, there seems to be a greater appreciation of the fact that men selected for early or immediate promotion must be trained and coached in the principles of leadership in advance of their appointment to supervisory positions.

At one important mechanical department headquarters a class is being conducted which is composed entirely of men who are studying to fit themselves for promotion to supervisory positions. Apparently—and possibly this is to be expected—these men are taking a greater interest in such studies than did a similar class made up of men already holding supervisory positions. It is significant, also, that some of the apprentices are deliberately looking forward and planning to fit themselves for supervisory positions. This movement has undoubtedly been stimulated by the various Younger Railroad Men's Conferences which have been held in recent years under the direction of the Railroad Y. M. C. A.

The Industrial or Human Relations Conferences, held under the direction of the Industrial Department of the Y. M. C. A., and particularly those at Silver Bay, N. Y., Blue Ridge, N. C., and Estes Park, Colo., were attended last summer by a much larger number of railroad representatives than formerly, and have had a splendid effect in inspiring an interest in more effective leadership, and also in helping to improve human relations and bring about a higher degree of teamwork and co-operation.

It is being recognized more and more in industry that the best results in foremanship or leadership study classes can be achieved with properly directed discussion groups. The great difficulty has been to find men who have the ability or understand the technique of leading such groups. The experimental movement which was first started only a few years ago to train leaders for such discussion groups, has both been found so effective that a number of these special intensive conferences for training men to lead discussion groups on foremanship or

leadership questions, have been scheduled for the coming months. These are being fathered by various organizations interested in industrial and vocational training.

There has been a steady increase in the number of supervisors' clubs or organizations. On the other hand, some of the older clubs have slowed down or have discontinued their organization. While the number of those that have fallen by the wayside is a small percentage of the whole, it does suggest that critical attention should be given to the reasons that make for the marked success of some clubs, and also to the reasons, on the other hand, why some of the clubs have failed. The work is so really worth while, as evidenced by the testimony of many officers and supervisors, that it should be allowed to fail. A worth while movement of this kind does not run itself, but requires constant study and effort in order to keep up the interest and meet the changing conditions. Is not this question of so great importance to the mechanical departments of the railroads, and to the other departments as well, that the Mechanical Division of the American Railway Association could well afford to take the initiative in a study which would make available to the railroads information as to the best ways and means of educating the officers and supervisors in the application of the principles of sound and successful leadership, and in insuring the permanency of such activities?

Railroad buying of machine tools

The railroads have many times been the object of criticism for the manner in which they purchase machine tool equipment, the relatively small volume of purchases as compared with other industries and, in many cases, for the quality of machine tools they buy. Much of this criticism has been fostered by a comparison of railroad methods and facilities with those of other more highly specialized industrial organizations.

Many changes are taking place in the industrial world and the manner in which the railroads of this country have been able to function under the added burden of the last ten years would indicate that they have at least kept pace in the march of changing events. Not the least important of the many changes in the railroad field has been the marked improvement in the design of motive power which in turn, with more intensive utilization, has demanded higher maintenance standards. The maintenance of motive power is the one and only function of a locomotive shop and upon its demands depends the requirements for new shop machinery.

Attention has been drawn to the relatively greater amount of older machinery in railroad shops as compared with some other industries. The most authentic inventory of railroad shop equipment is that contained in the valuation records of the Interstate Commerce Commission which are now practically ten years old and any study based upon that information would present a picture of the physical condition of railroad shop equipment before the marked changes of the past ten years had begun to take place. The Class I railroads of this country now spend annually for new shop machinery over three times the amount considered necessary for normal rehabiltation of facilities ten years ago. Considering the fact that this expenditure bears, at the present time, a direct relation to net earnings, it is reasonable to suppose that along with an anticipated increase in railroad earning power the annual machine tool expenditures will show a consistent increase.

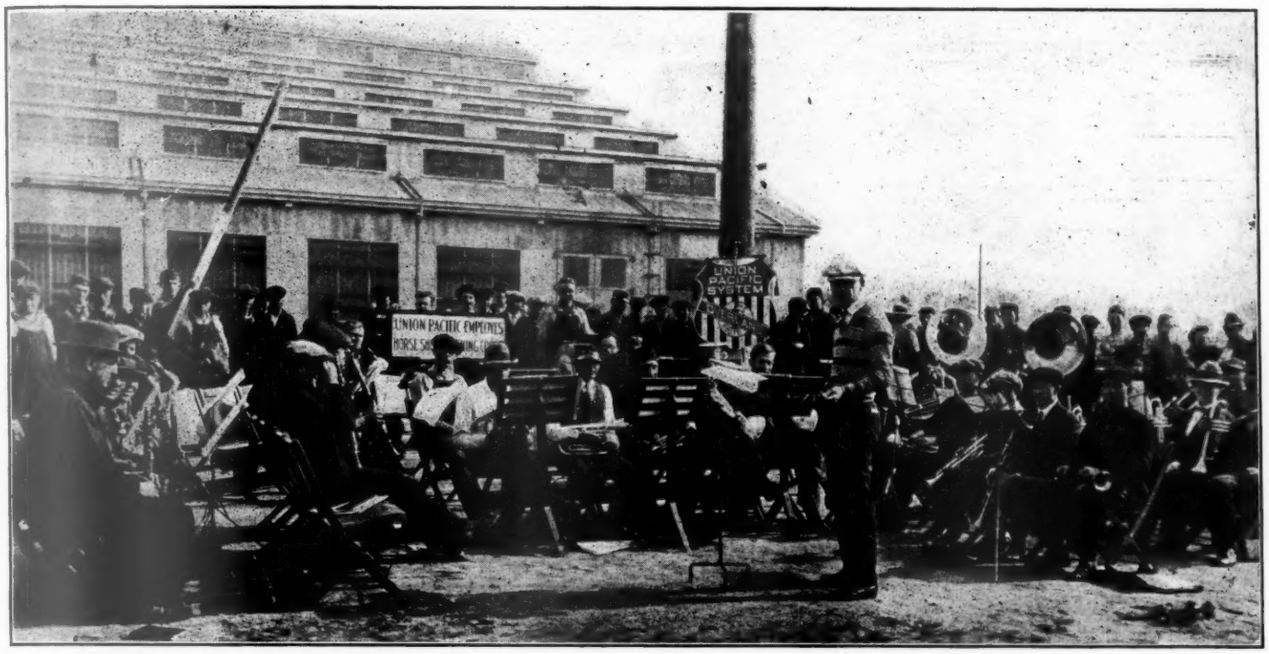
The railroad market for machine tools represents from ten to fifteen per cent of the total distribution of machine tool equipment in the types used by railroad shops and in money value represents an annual expenditure of from twelve to fifteen million dollars. Upon a complete mutual understanding of the railroads' demands for machine tool equipment and the manufacturers' problems of production and marketing will depend the intelligent spending of this amount by the former and the selling success of the latter.

The requirements of a railroad for machine tools may be divided into two general classifications: high-grade production tools for the main repair shops where high capacity, long service life and a high degree of accuracy are required; a somewhat less expensive, yet serviceable tool for the smaller outlying shops and engine terminals where only running repairs are made. This, then, should determine the type and quality of machine needed to handle the job for which it is being purchased. Obviously no railroad should be expected to buy a high-grade, high-capacity machine for a relatively unimportant repair point, nor should it expect any other grade of machine to stand up any length of time under the service conditions imposed by production demands.

The mechanical department has just about so much money to spend each year on new machinery and because this appropriation is usually somewhat less than seems to meet the needs for new tools, it is of paramount importance that every dollar of it is wisely spent. Without going too much into detail it is desired to call attention to a change that is taking place on some of the more progressive railroads which has much to commend it to all roads when intelligent machine tool selection and purchasing methods are being considered. First, machine tools are selected on the basis of the service that is going to be demanded of them; second, accurate service records of the maintenance cost of all machines in service are being maintained in order to know what make and type of machine is rendering the best service and to determine accurately when the economic turning point in the life of a machine has been reached; third, the mechanical department specifies the make and type of machine which will fill the requirements in the service classification for which it is intended and finally, the purchasing department has the authority to buy only from the manufacturers whose names are mentioned as making a machine of the quality demanded. This method of machine tool selection has stood the test of trial in other industries for several years and in adopting it the railroads need have no doubt as to the assurance that it will result in their acquisition of a much higher grade of machine tools than has been the case many times.

From the manufacturers' standpoint an improvement in methods of selection along such lines would result in greater profits from railroad sales through the elimination of the necessity of following up by personal calls the inquiries for machine tools on which there is no reasonable assurance of sales success. Price, consistent with quality, ceases to be a dominating factor in purchasing—the manufacturer must be assured of a fair price in order to make improvements in design and render the service necessary on his product.

The railroads today are faced with the necessity of plant rehabilitation in order to keep pace with the demand for motive power. Their earnings in the past few years have made purchases of new machinery possible on a larger scale than heretofore. The manufacturers of machine tools adaptable to railroad work can both profit and render a valuable service in assisting the mechanical departments in the intelligent selection of the proper tools for the service demanded and, in assisting the roads to prepare specifications and inquiries in a manner such as to eliminate the bidding by manufacturers of equipment not suited to the particular demands, will be able eventually to realize a more satisfactory profit from an increased volume of railroad sales.



Noon concert of Union Pacific employees' band

L. A. & S. L. heavy repairs centralized at Los Angeles

Union Pacific shops in Southern California, notable for equipment, orderliness, good workmanship and high employee morale

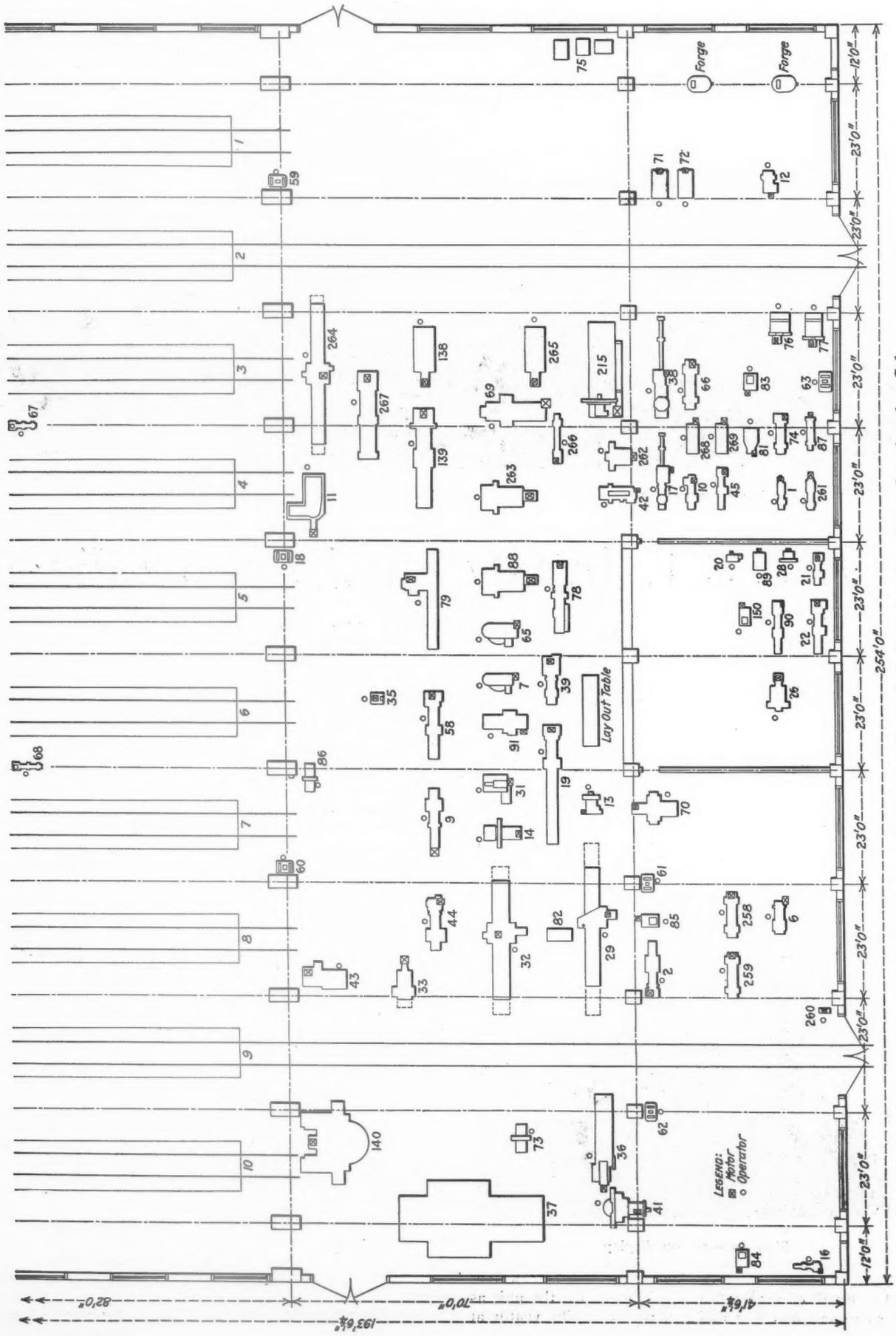
LOCOMOTIVE maintenance work on the Los Angeles & Salt Lake unit of the Union Pacific System has been centralized at a relatively few points, of which the new shops at Los Angeles, Calif., are now

Shop banners on display

equipped to accommodate the largest modern locomotives and handle all of the general repair work for the unit as well as some Class 4, 5 and 5½ repairs. The visitor at the shop is first impressed with the modern shop equipment and machine tools available for locomotive maintenance work, and, second, with the general order and cleanliness everywhere apparent. In fact, all of the buildings in the locomotive and car departments, storehouse, and engine terminal are maintained in an excellent state of repair, well-painted and with shop grounds profusely decorated with beds of flowers and shrubs largely cared for by the shop men themselves. Carefulness about general shop conditions is conducive to carefulness in handling locomotive repairs, and the emphasis placed on this feature at Los Angeles shops has resulted in a notably high grade of workmanship and freedom from engine failures, there being some months in which no failures occur, although approximately 191 locomotives are in service daily. The last feature of the work at Los Angeles shops, though by no means the least important, is the sincere and concerted effort made to provide shopmen with every possible facility for self-improvement, education and healthful recreation outside of working hours, in order that they may become more valuable to themselves and to their road.

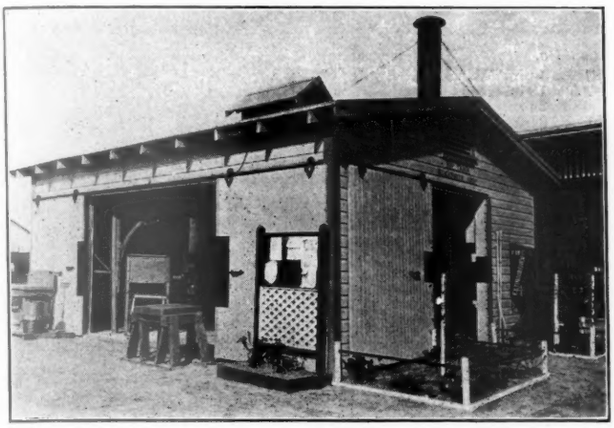
Numerous water fountains and urinals are conveniently located to save steps and all through the shop an effort has been made to help the men and make things convenient so that they can and will remain at their work.

In a like manner all ordinary "traps" are removed and



Modern machine tool layout at L. A. & S. L. locomotive shops, Los Angeles, Cal.

instead of lecturing men for putting material, etc., on top of cupboards or on sills, a slanting roof of timber is applied so that material will not stay up there. As far as practical, a metal vise bench is provided that is merely a pedestal and offers no place to gather trash and this eliminates the necessity for a supervisor to order frequent general clean-ups. When not in use, all tools



The rip track blacksmith shop is a model of neatness

are required to be kept in regular places assigned for them.

Sensitive drill presses, radial drills, and grinding wheels are scattered around the departments so that the men have access to them without walking across the entire shop. Two portable engine lathes in the erecting shop save considerable time in the fitting of locomotive frame bolts.

Department locations carefully studied

Before the new shops were built about two years ago, they were laid out with small blue cardboards, representing the various machines and departments, pegged to the floor plan; then foremen singly and in groups studied, discussed and relocated the cardboards until they were satisfied as to the respective locations. Prints were made and studied by many men and foremen and criticized frankly since, in the end, the men and foremen are held responsible for the output of each department, and it is necessary that machines be arranged to save labor and minimize lost motion.

The average monthly output at Los Angeles locomotive shops is two No. 2 repairs; (See Table I) six No. 3 repairs; two No. 4 repairs and three No. 5 repairs. The man-hours for classified repairs are as follows: Class 2, 6,907; Class 3, 5,115; Class 4, 2,340; Class 5, 1,244. The average force employed is 362 and the total number of foremen, nine. The number of men in each major department is as follows: Machine shop, 71; erecting shop, 68; boiler shop, 89; blacksmith shop, 24; pipe shop, 25; electric shop, 8; tool room, 16; air and cab, 22; welding shop, 15, and labor force, 24. During the average month 3,984 man-hours are spent on store order work, or approximately six per cent of the total, and on work equipment, 2,434, or approximately four per cent of the total. The aggregate man-hours for both store order work and work equipment are, therefore, 10 per cent of all the man-hours worked.

Table I—Definition of class repairs on the L. A. & S. L.

Class 1—New boiler or new back end and general repairs to flues and machinery which will put locomotive in condition to perform full term of service in the district and class of service to which assigned.

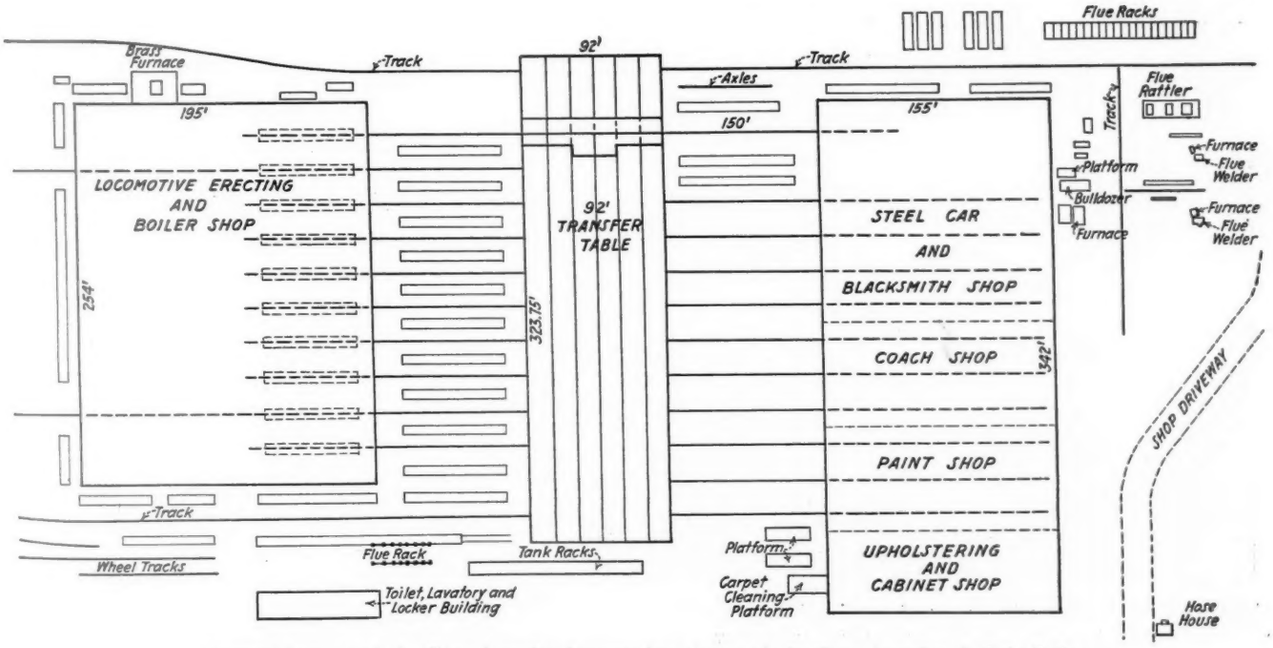
Class 2—New fire box or one or more shell courses or roof sheet, and general repairs to flues and machinery to put locomotive in condition to perform a full term of service in the district and class of service to which assigned.

Class 3—General repairs which will put locomotive in condition to perform a full term of service in the district and class of service to which assigned.

Class 4—Heavy repairs which will put locomotive in condition for performance of not less than one-half term of service in the district and class of service to which assigned.

Class 5—Light repairs which will put locomotive in condition to perform not less than one-quarter term of service in the district and class of service to which assigned.

Class 5½—Light repairs costing over $75 at any one time but which do not improve the condition of the locomotive for at least one-quarter term of service in the district and class of service to which assigned.

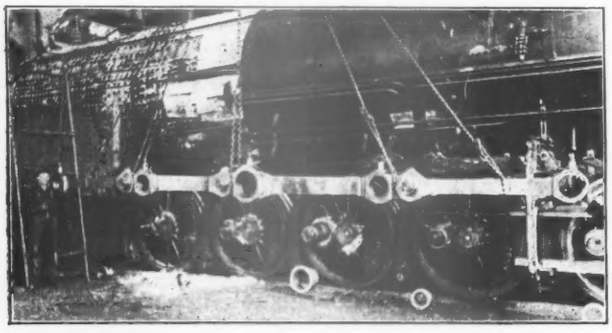


General layout of the Los Angeles locomotive shops of the Los Angeles & Salt Lake

The thorough-going repair work at Los Angeles shops is initiated with the arrival of a locomotive at the shops. The water is drained from the cistern or tank in the enginehouse, the locomotive then being moved to an oil sump built on a track leading from the enginehouse to the back shop for the purpose of draining the fuel

oil tank. The locomotive is moved with the shop switcher to the back shop and disconnected from the tender, and then over the transfer table to the erecting shop where it is placed in stall No. 1 in the erecting shop. Before any dismantling work is performed, the boiler is filled with water and a pressure of 100 lb. applied for the purpose of testing for cylinder or steam chest leaks, also leaks at the cylinder and valve chamber heads, superheater header and steam pipes.

After making this test, any defects found are given



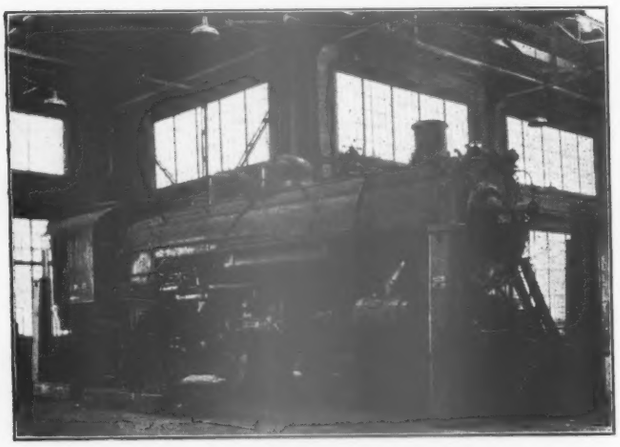
A labor-saving method of applying side rods to locomotives

attention while other repairs are being made to the locomotive, thereby avoiding delay when the locomotive is being taken out of the shop.

All parts thoroughly cleaned and inspected

After this test is made, a stripping gang dismantles all parts from the locomotive that require repairs. Laborers remove these parts to the lye vat outside the shop for cleaning and from that point the same men distribute them to the various departments to which they must go for repairs. All parts are painted with whiting, and are then inspected and vibrated to disclose defects.

The frames, after being wiped, coated with whiting



Modern facilities for wheeling and unwheeling locomotives form an important part of the shop equipment

and vibrated for defects, are brought as nearly as possible to perfect alinement. All bolts and frame keys are tested, braces and expansion pads inspected and renewed if defective. Plain cross braces are welded when practicable to do so but no attempt is made to weld box-type braces. Cylinders or valve bushings that are out of round or tapered are re-bored or re-bushed if necessary. They are tested for tightness in the cylinder fit and also gaged to determine if valve ports are of the proper dimensions and the proper distance apart.

Unusual care in wheel and box work

Pedestal jaws are trued to a face plate, pedestal binders properly fitted, and shoes and wedges laid out exactly to blue print from two lines running through the cylinders. Shoes and wedges and pedestal binders are put in place. The main centers of the locomotive are then trammed and made to tram right before putting on the side rods.

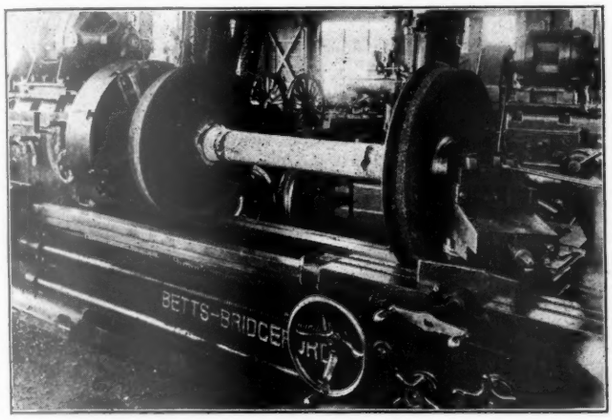
Table II—Machinery at the Los Angeles locomotive shop

Shop No.	Description	Motor hp.
1	14-in. Warner & Swasey brass turret lathe	2
2	18-in. Hendey lathe	5
6	24-in. Putnam engine lathe	7½
7	24-in. Bullard vertical turret lathe	7½
9	14-in. Niles horizontal boring mill	7½
10	14-in. Le Blond lathe	2
11	5-ft. Pond No. 10 radial drill	10
12	4-in. Oster pipe threading machine	1½
13	24-in. Baker Bros. vertical drill press	5
14	30-in. Morton draw-cut shaper	10
16	10-in. Monarch bench lathe	¾
17	28-in. Warner & Swasey turret lathe	5
18	Double emery grinder	5
19	24-in. Barker & Chard lathe	7½
20	No. 100 Yankee drill grinder	2
21	14-in. Springfield lathe	2
22	16-in. Hendey lathe	3
26	No. 3 Hendey universal milling machine	7½
28	No. 2 Oakley universal grinder	1½
29	36-in. Detrich & Harvey planer	20
30	Swing polisher	5
31	26-in. Niles crank shaper	5
32	42-in. Niles planer	20
33	18-in. Dill slotter—1t-18	5
34	U. S. emery wheel	10
35	13-in. Lindgren bench drill	1
36	96-in. Southwark 500-ton hydraulic press	12½
37	90-in. Putnam driving wheel lathe	50, 7½, 3
38	26-in. Pratt & Whitney turret lathe	10
39	24-in. Boye & Emmes lathe	10
41	42-in. Niles vertical boring mill	10
42	28-in. Columbia crank shaper	7½
43	5-ft. Niles radial drill	7½
44	23-in. Le Blond heavy duty lathe	10
45	14-in. Springfield lathe	3
58	24-in. Monarch engine lathe	10
59	U. S. electric grinder	5
60	U. S. electric grinder	5
61	U. S. electric grinder	5
62	U. S. electric grinder	5
65	42-in. Bullard vertical turret lathe	15
66	18-in. Monarch engine lathe	3
67	14-in. Monarch portable lathe	2
68	14-in. Monarch portable lathe	2
69	24-in. Betts-Bridgeford crank slotter	10
70	No. 2 Sundstrand radial link grinder	7½
71	Metal cutting machine	1
72	Metal cutting machine	1
73	Chambersburg 50-ton hydraulic bushing press	5
74	No. 4 W. & S. universal turret lathe	3
75	Hoskins electric furnace	..
76	1½-in. Landis 3-head bolt cutter	5
77	2-in. Landis 2-head bolt cutter	5
78	28-in. Gisholt turret lathe	15, 2
79	15-in. Norton surface grinder	20, 5, ½
81	34-in. W. F. & J. Barnes drill press	2
82	Underwood planing attachment	..
83	½-in. Leland Gifford sensitive drill	1
84	½-in. Leland Gifford sensitive drill	1
85	¾-in. Allen sensitive drill	¾
86	50-ton Lucas bushing press	5
87	4-in. Whiton centering machine	½
88	36-in. Morton draw-cut shaper	15
89	Wilmarth & Morman tool grinder	2
90	14-in. Springfield lathe	2
91	32-in. Woodward & Powell crank planer	5
138	6-ft. Western radial drill	20
139	42-in. Betts-Bridgeford engine lathe	30
140	8-ft. Betts boring mill	30, 5
141	Mahr melting furnace	..
150	¾-in. Allen sensitive drill	¾
215	Driving wheel lathe	..
258	20-in. Monarch lathe	5
259	20-in. Monarch lathe	5
260	Bench grinder	½
261	Brass lathe	5
262	Milling machine	15
263	Draw-cut shaper	15
264	Cincinnati planer	20
265	6-ft. Western radial drill	10
266	24-in. Monarch engine lathe	7½
267	36-in. Betts-Bridgeford engine lathe	20
268	No. 2 Victor nut facing machine	1½
269	No. 2 Victor nut facing machine	1½

Crank pins are plummed on the right side, putting the left crank pins on the back centers. The locomotive is then ready for application of left side rods, the right rods being handled similarly. The rods, overhauled and brought to standard length at the rod bench, are assembled, supported by chains from the shop crane as shown in one of the illustrations, and applied as a unit. They must slip on freely.

It is the practice first to check the driving wheel tires to see that they gage properly between the treads. If found not of the proper spacing, changes are made on the wheel center to correct the position of the retaining shoulder, Tobin bronze being used to build up the wheel center to the proper dimensions. All driving journals are turned at each overhauling. All crank pins are pressed out and holes tried in the quartering machine. Any that may be out are rebored and in all cases new crank pins are applied. Tires are brought to the standard contour on the 90-in. wheel lathe.

Driving boxes are overhauled in the following manner: Old brasses are pressed out, brass knocked off the shoe and wedge and hub faces, whiting applied and the boxes tested for defects. Then they are taken to the brass foundry and the brass poured on the shoe and wedge and hub faces. The boxes are taken to the draw-cut shaper where they are reslotted both on the brass fit and the cellar fit. They are then delivered to the boring mill and counterbored for the collar on the driving box brass. Brasses are machined on the draw-cut shaper and pressed in. The boxes are taken to the planer and the shoe and wedge face planed to standard dimensions. They are delivered to the boring mill where the hub face is brought to the proper thickness to maintain the lateral called for on the blue print, and the brass bored to the proper size for the journal. Oil grooves are chipped on the shoe and wedge faces and the small holes on shoe and wedge faces drilled to the oil pockets. Holes are drilled and counterbored for the driving box plugs, which are applied. The boxes are finally spotted to the journals and the cellars fitted.



Betts-Bridgeford 42-in. engine lathe recently installed

Modern machine equipment installed

The location of the up-to-date equipment for machining important parts such as driving wheels, boxes, motion work, rods, brake rigging, spring rigging, etc., is indicated on the floor plan which shows the complete machinery layout. Reference numbers in the drawing refer to machines listed in Table II.

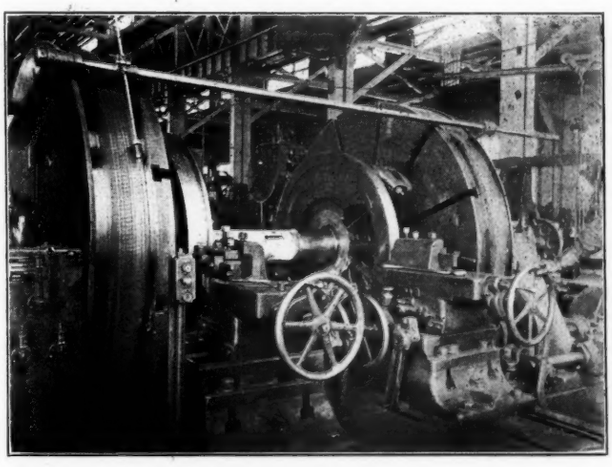
Valuable machines in the machine shop from a production standpoint are the draw-cut shaper, the vertical turret lathe, the horizontal boring mill, the wheel lathe and the modern engine lathes, turret lathes and drilling machines. On the draw-cut shaper, 10 driving boxes are machined in 8 hr. or 12 fittings of driving box brasses in 8 hr. For machining cylinder packing rings, the vertical turret lathe has a capacity of twenty-four 30-in. rings in 6½ hr. The capacity of the horizontal boring mill on rod work is one set of rods for a 10-coupled engine in 6 hr. The wheel lathe turns a pair of 72-in. tires from floor to floor in 52 min. It is equipped with a double quartering attachment which has been used to bore crank pin holes in two sets of driving wheels, 16 holes, in 8 hr.

In the boiler shop the two-spindle radial drill press, McCabe flanger, combination punch and shears, Landis bolt cutters, bending rolls and air clamp are effective tools. Superheat flue sheet holes are cut out in one minute each and the 2-in. flue holes are drilled, reamed and counter-bored in two minutes each. The McCabe flanger is a great improvement over the old method of hand flanging. The combination punch and shears will handle the work as fast as it can be brought to the machine. On a triple head bolt cutter, 150 staybolts can be cut per hour.

It is the practice on the L. A. & S. L. to weld all flues in the firebox, and all flues above the superheat line in the front end. All mud ring corners are also welded because that is the part of the mud ring that gives the greatest trouble. The greatest precautions are necessary in performing boiler work at Los Angeles shops, owing to the fact that this unit of the Union Pacific operates under extremely bad water conditions. Fireboxes are renewed about every four years. Superheater flues run from one shopping to the other, when about 25 per cent are scrapped due to corrosion on account of unusually bad water.

On large locomotives which require firebox renewal, the boiler is cut loose from the cylinder saddle and taken to the boiler shop for application of a firebox. This avoids cutting the butt-end off, or removing the back boilerhead, renewing boiler braces or rivets in the boilerhad, removing rivets and their re-application, which saves considerable labor.

The flues are handled to and from the flue shop on a flat car. They are then taken from the flat car by a locomotive crane and placed on a rack above the flue rattler and allowed to roll in by gravity. The rattler is elevated and when the doors are opened the flues roll out by gravity on a push car provided for that purpose. After repairs have been made to the flues they are loaded back on the flat car by the same locomotive crane. The flat car is then moved in front of the locomotive, making it convenient for men putting flues in the boiler. A specially designed push car is provided for handling superheater units out of the locomotive and when putting them in. The superheater units are lifted from the truck which is of the same height as the front end of the loco-



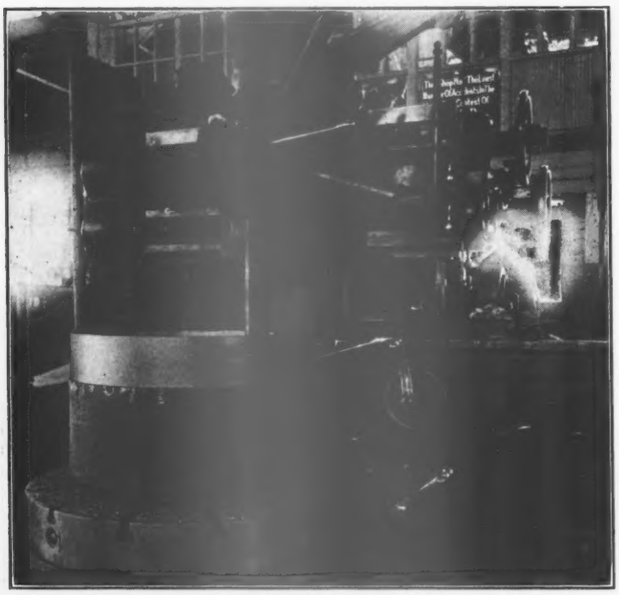
Putnam 90-in. wheel lathe for turning tires and quartering wheel centers

motive and are placed back on the locomotive from the same truck.

The locomotive is tested in accordance with federal requirements. Superheater units, steam pipes and nozzle stands, cylinder heads and valve heads, after application, are given a special test with cold water at a pressure of 100 lb. The testing of the boiler is performed in accordance with the federal laws, also the setting of safety valves and testing of the air brake apparatus. After the boiler has been tested and any defects corrected, the boiler is lagged and the jacket applied. The locomotive is moved to the enginehouse and the boiler given a thorough washout. It is then ready for a break-in and seldom returns to the back shop.

Locomotives are broken in by running them up and down a track in the yard limits for eight hours. After returning to the enginehouse any necessary adjustments are given attention. Then each locomotive is run on a slow train a number of trips until it is in sufficiently good running condition to go into the regular service in which it belongs.

While no form of piece work or bonus system is



Bullard 42-in. vertical turret lathe machining cylinder packing rings

employed to stimulate production, it is felt that equally good results are secured with day work, owing to the unusually high morale of the shop employees. Good quality of work is obtained by close supervision and rigid inspection of all details. A simplified schedule system, prepared by the general foreman and having progress dates posted conspicuously on bulletin boards, is in force.

Excellent co-operation secured

No description of Los Angeles shops would be complete without an outline of the methods used to stimulate co-operation on the part of all foremen and shop employees. The men are encouraged to improve themselves both mentally and physically and opportunity is afforded for their recreation outside of working hours. All are treated fairly and, while a friendly family spirit exists to a marked extent, shop discipline is strict and no foolishness tolerated.

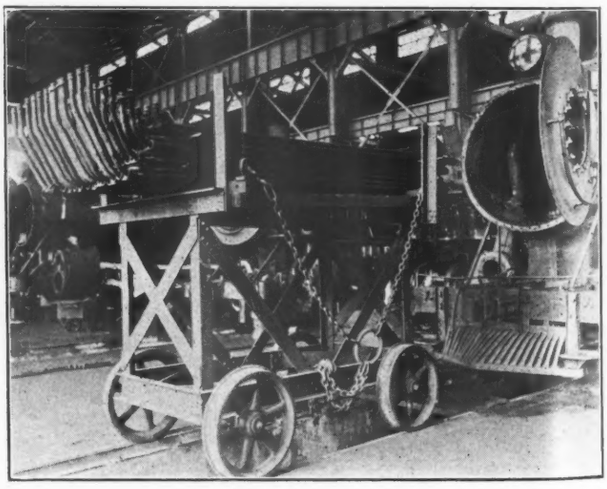
The subject of American citizenship is kept before the men and clubrooms and assembly rooms provided for patriotic and educational meetings. No attempt is made to dictate to any man religiously, but the management does try to direct the thought of the men along proper channels, appealing to their better sides and encouraging them to become good citizens and loyal Americans as well as faithful employees of the Union Pacific System. The satisfaction of the men with general shop conditions is one of the important factors in the good work turned out.

At all points along the line of the Los Angeles &

Boring a main rod back end on a Niles horizontal boring machine

Salt Lake, the railroad co-operates with various educational institutions in providing night school instruction. In the Los Angeles high schools, shopmen enroll in the night classes and study in the evenings, working at their respective jobs during the daytime and a considerable number of apprentices have become interested in this work.

Every opportunity is afforded the men and foremen to participate in the control of shop conditions. In accordance with Union Pacific practice, council meetings



Convenient truck for handling flues and superheater units

are held monthly, at which a member from each craft sits with the supervisors, a chairman being elected for each meeting in advance. At these meetings, those present discuss workmanship freely, criticize each other frankly, suggest ways and means of facilitating the work, tell of anything that is handicapping the output, report any shortage of material, discuss the location of machinery, any lack of co-operation, etc.

The apprentice board, consisting of the apprentice instructor and several foremen, meets every 90 days to discuss the apprentice grades and performance and recommend corrections to the shop superintendent.

The safety committee, consisting of foremen and representatives of all shop crafts, meets each month to review the accidents and make recommendations. The Los Angeles shops won the banner for being the safest shop on the Union Pacific System for 1925 and 1926.

Shop foremen meet once a month and discuss shop output, schedules, routing standards, instructions, etc.

The Union Pacific management takes an interest in the men at play, and has encouraged the organization of an athletic club at each of its terminals, the men to complete in all activities. Ball teams have been organized at Los Angeles (which holds the championship of the system), Lynndyl, Utah, Milford, Utah, and Las Vegas, Nev.; tennis teams at Caliente, Nev., Las Vegas and Los Angeles. Employees at Lynndyl have a 10-year lease on 4,000 acres of land, for hunting and fishing. There are system bands at Los Angeles, Las Vegas, Milford, Caliente; basket ball teams at Las Vegas, Milford, Los Angeles, Caliente, and Lynndyl. In addition, at Los Angeles and Las Vegas there are four indoor base ball teams, and horse shoe pitching teams; there are quartets at Lynndyl, Las Veges, and Los Angeles, and an orchestra at Los Angeles. This movement has only been in effect on the unit a little over a year, but it is rapidly gaining in interest and activity and is productive of much good.

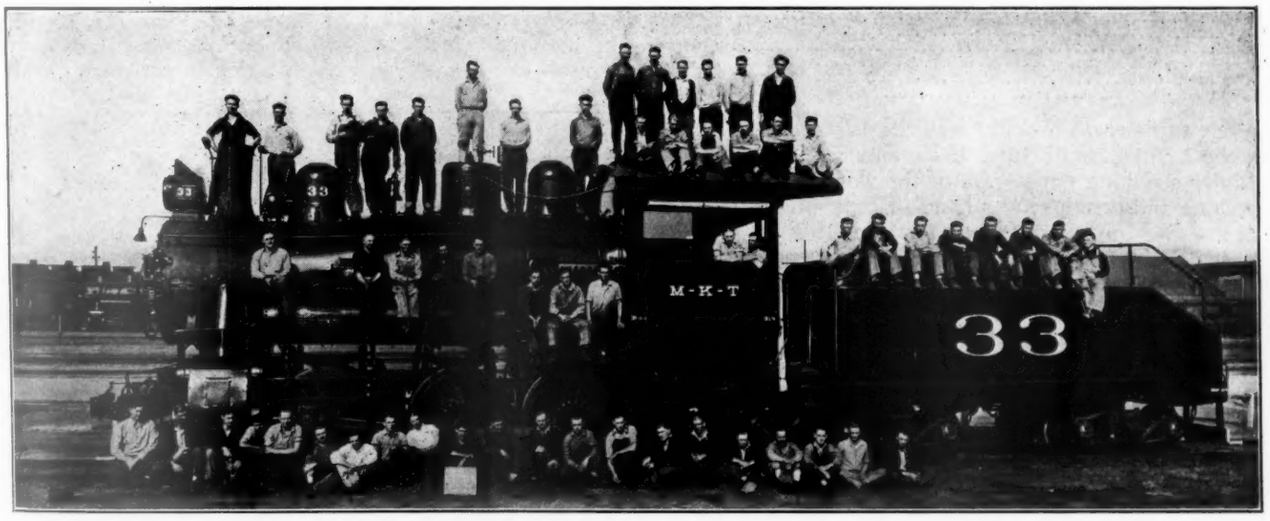
Katy apprentices overhaul six-wheel switcher

By T. C. Gray

Supervisor of apprentices, Missouri-Kansas-Texas, Parsons, Kansas

WHY is it not important that the railroads give attention to the selection and improvement of their human equipment? Their materials, laboratories, and physical equipment are purchased and maintained under very rigid specifications and requirements. Which is the more important; good labor or good material? Certainly the railroads want and need both and, in fact, must have both to render the efficient service which the public demands of our transportation systems. We hear and read a great deal regarding foremanship training. Foremanship conferences are being conducted by some roads. Classes in foremanship are held by others. Supervisors clubs have been organized on some roads and one of the functions of the majority of these clubs is to give the foreman a better understanding of his job. Some one has said, "You can't teach an old dog new tricks." Like all other rules or proverbs, the foregoing expression has a few exceptions. However, the writer wonders just what percentage of present day shop supervisors are intensly interested in modern foremanship.

A well known and successful university football mentor has placed his system of football in the high schools of the state and is now even working with the grammar school boys. This coach surely has several advantages over the man who has to "make over" his material when it enters the university. Good foremen come from good mechanics; good mechanics are the result of the proper selection and training. The majority of the roads could take several lessons from the foregoing successful coach and start their foremanship training in the right place—the apprentice school. Can there be a more nearly ideal training and developing of the future personnel of the mechanical department than by the apprenticeship route?



M-K-T apprentice boys at Parsons, Kans., shops, and the locomotive they overhauled by themselves

H. M. Warden, mechanical superintendent of the

Missouri-Kansas-Texas realizes the false and absurd economy of wasting good material with poor labor. He looks upon his apprentice department as of vital importance and keeps in close touch with the manner in which the boys are handled, both in the school and in the shop. He frequently calls some of the advanced apprentices into his office and tells them of the late trend in locomotive or car design and performance. He attends as many of their meetings as possible and not only manifests an interest in their affairs but shows them in many ways that he is keenly interested in them. He tells them that their chances for advancement depend entirely upon their application and interest. There are a great many jobs in the locomotive shop that the majority of boys miss while serving their time. How many apprentices have a chance to turn and fit new crank pins or axles? How many apprentices have a chance to layout and fabricate a new firebox? How many apprentices have a chance to set the valves, figuring the changes and all? How many apprentices have a chance to counterbalance an engine? These and many other jobs are missed by most apprentices. In most large shops where apprentices are found, the apprentice will probably help a mechanic on a few of the above jobs but will not be put "on his own" and will not receive the proper training or instructions on any of these jobs. The writer obtained the majority of his valve experience underneath an engine as "engineer" on the air motor which actuated the roller mechanism.

Mr. Warden decided over a year ago that the only solution to this problem would be in letting the apprentices overhaul one engine completely at each large shop point each year. This was to be a small engine and run through the shop on regular schedule.

The first engine selected was No. 23, Class B2a, a six-wheel switcher having the following principal dimensions:

Tractive force	29,300
Cylinders	20½ inches by 26 inches
Tires	57 inches
Steam pressure	180 lb.
Valve and gear	Piston—Stephenson
Weight on drivers	138,000 lb.

The engine was brought into the Waco, Texas, shops in the latter part of July, 1926, and dismantled by the regular stripping gang. All of the work, including both machine and erecting, was handled by apprentices. The engine was changed from saturated steam to superheat. The major items entailing new material are listed below:

Firebox	Steel cab
Fluesheets (both front and back)	Dry pipe and steam pipes
Cylinders (piston valve)	Pistons, crossheads and guides
Bronze shoes and wedges	Valves
Driving boxes	Furnace beams
Crown brasses	Exhaust stand, tip and stack
Tires	Main rods and bushings
Steel eccentrics and straps	Pipe work
Axles and crank pins	

General repairs were made to the brake and spring rigging, rods, valve motion, etc. The tank was rebuilt and the engine was turned out of the shop on August 31, 1926, and assigned to the South Texas District. On April 30, 1927, it had 15,000 miles to its credit. There has been an unusually low number of reports and the engine has given exceptionally good service. The chief locomotive inspector reported the latter part of October:

I inspected Engine 23 at Denison, October 23, 1926. This engine was given a class 2 repair at Waco shop last August and has been in service at Denison ever since. All of the work which included superheating, new cylinders and new firebox, was done by apprentices and after three months' service the engine shows practically no defects and is in excellent condition. The master mechanic stated that the expense of upkeep and running repairs has been very small.

The chief locomotive inspector was very much interested in this experiment and watched this engine closely.

Engine 33, similar to the 23, was overhauled by apprentices at the Parsons, Kansas, shops in April, 1927. The shop was working a five-day week and the engine followed the regular shopping schedule which follows:

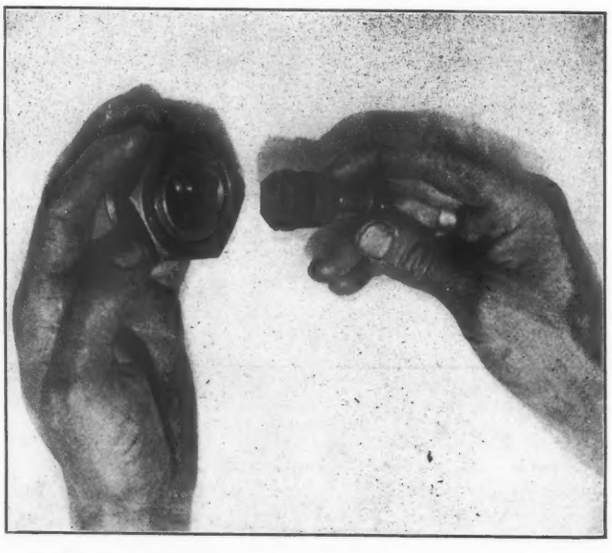
Engine number	33
Class of repair	3 C F S 2
Engine in shop	March 25
Tank in shop	March 25
Engine stripped	March 26
Engine inspected	March 28
Lagging removed	March 28
Cap removed	March 31
Boiler work completed	April 21
Boiler fittings applied	April 21
Boiler tested	April 22
Cab applied	April 23
Lagging and jacket applied	April 27
Frames and cylinders	April 15
Shoes and wedges	April 26
Guides and pistons	April 26
Valve motion	April 27
Steam pipe and cab fittings	April 27
Spring rigging applied	April 26
Trucks and trailers	None
Wheels completed	April 26
Engine wheeled	April 27
Tank applied	April 29
Steam pipes tested	April 29
Valves set	April 29
Rods completed	April 29
Brake rigging completed	April 29
Pipe work completed	May 2
Electrical work completed	May 3
Engine out of shop	May 3
Engine O.K. for service	May 5

This idea has stimulated a great deal of interest among the apprentices and is a splendid thing. As one boy expressed himself after working on Engine 33, "I have read about it and studied about it, been told about it and shown how to do it; but now, I have done it."

A good one to remember

By Frank Bentley

THE illustration shows a good substitute for a wrench to tighten bullseye glass followers. A ½-in. hex nut just fits the hex in the follower. A monkey wrench can be applied to the portion of the nut extending beyond the follower. If the casing will not allow it, two nuts locked on a small ½-in. bolt leaves the square bolt head for the wrench. Occasions sometimes arise for tightening followers on the road with no plug or follower wrench available.



A substitute wrench for tightening bull's eye glass followers

The economics of machine tool maintenance

Individual machine tool repair cost and service records an accurate guide in determining repair or replacement policies

By Warren Ichler

IN considering the problem of keeping the shop tools necessary for locomotive and car repairs in a reasonably productive condition, we have to remind ourselves constantly of the nature of this service to the consuming public. In brief, it is a preparation for the sale of locomotive and car mileage to those who in turn sell this carrier mileage to the consumer. One has only to recall the arguments about the value of the final service —the transportation of passengers and freight—to realize how deeply obscured is the dollars and cents value of this phase of a phase of a public service which is always treated as an indirect and intangible commodity. All

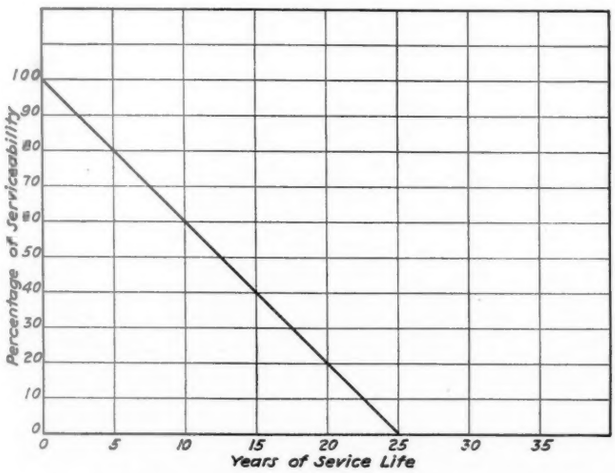


Fig. 1—Theoretical depreciation curve in which no reconditioning is involved

of which is fundamental and somewhat unpalatable to those responsible for railway shop maintenance; it has to be faced nevertheless.

On some roads an approach to definite locomotive mileage costs has been made by the adoption of an inflexible locomotive repair policy. That is, whenever a locomotive has made, say 80,000 revenue producing miles it is shopped for major repairs regardless of its physical condition. With this policy in force over a number of years it is possible to determine locomotive repair costs with reasonable accuracy and to analyze the costs in such a way as to allocate the internal costs of the repair shop, such as heat, light, supervision, machine-tool repairs, etc., but even if such exhaustive studies have been made in isolated cases they will still have only a comparative value.

With all of these discouraging factors of intangible values inconvenience, etc., in mind it is probable that no exact policy as to the maintenance of railway shop tools has ever been adopted or will be adopted for some time; but certain of the many arbitrary theories on this subject furnish valuable tools in meeting specific situations and conditions.

In the first place, just how fast do shop tools depreciate and when is it desirable to anticipate break-downs? At the risk of severe criticism, the writer has adopted as a base for his repair policies the theory that the ordinary, lighter machine tools wear out completely in 25 years when kept in continuous service; while the heavier, slower moving machine tools, such as large boring-mills and planers have a service life of 30 years. If this depreciation is expressed graphically it would evidently be a straight line as shown in Fig. 1, in which the ordinates are percentages of the original serviceability of the machine and the abscissae are years of service.

Of course this is only a starting assumption. A curve of the depreciation of the average machine would show peaks in years when the machine had received abnormal maintenance and the curve would never approach zero service value as a straight line because no machine is ever scrapped at exact zero value. A more typical curve of the service life of a machine tool would be that shown in Fig. 2.

Now if the various units of a machine tool could be so nicely balanced that the heavier supporting castings and the lighter working parts wore out evenly and the whole thing went to pieces "all in a day," like Mr. Holmes' immortal carriage; we could buy and use the machine to complete destruction and mere scrap value without a further unbalancing of the whole structure by the application of repaired or new unit parts. Subsequent replacement of the tool could be effected with a minimum adjustment of the capital account (account 44), by adding to, or subtracting from the account the monetary difference between the installed value of the original and the replacement unit. This matter of adjustment of investment accounts will be amplified in a later paragraph.

Original cost determines advisability of rebuilding machines

This brings us to a second major premise in formulating an entire repair policy. Briefly, this proposition is to select some point in the capital account, below which value machines shall not receive major repairs. This is apparent, almost without recourse to accounting, since every mechanic knows the futility of rebuilding such machines as small power hack-saws, small sensitive-drills and other light machines of limited functions. In many cases involving complete re-conditioning of machines of this kind the repairs cost more than would a new machine of like possibilities. After some analysis of the matter the broad general conclusion was reached by the

writer that major repairs or complete rebuilding of any machine costing less than $400 new, would invariably involve a distinct monetary loss and would retard the more necessary repairs to larger tools. Hence, such small machines received only the simplest and least of emergency repairs and were used to zero value as nearly as possible, without reconditioning.

Of course the ideal condition of uniform performance and sudden, complete disintegration can be even remotely approximated in only the very simplest devices and has to be entirely independent of at least two of the three factors which affect the service life of machinery; namely obsolescence, inadequacy and uselessness. A very slight consideration will show that a power hack-saw, for example, will never be obsolete for the work for which it was primarily intended and that such work will always have a useful place in machine shop operation.

When one considers the larger and more valuable machinery units, however, it is evident at once that the factor of adequacy must be given consideration and that mere emergency repairs will not suffice as a continuing basic policy.

As an illustration of the operation of the adequacy factor, consider the case of a lathe used for turning locomotive piston rods, and fitted with cast-iron change gears for driving the lead screw and the feed-rod or splined shaft. Such a machine might be perfectly adapted to turning piston rods of wrought iron or mild steel; using carbon steel tools as cutting agents; and still be very inadequate both in quantity and quality of output when tough, alloy steel is used for piston rods and tools of high-speed steel or stellite replace those of carbon steel.

Faced with a condition outlined above, tool supervisors and foremen, generally, apply such remedies as will promise the greatest relief with least expenditure. Few will deliberately invite a serious disturbance of their

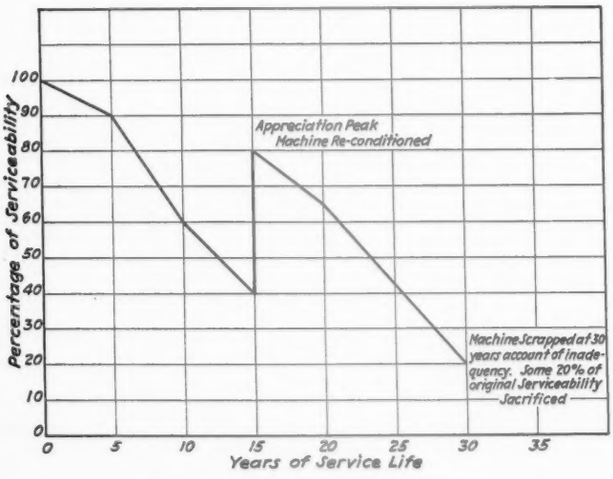

Percentage of Serviceability
Years of Service Life
Appreciation Peak
Machine Re-conditioned
Machine Scrapped at 30 years account of inadequency. Some 20% of original Serviceability Sacrificed

Fig. 2—Typical service life curve

work by a wholesale shop reconditioning program in spite of the many opinions to the contrary.

Transfer of work from an inadequate machine to one capable of satisfactory production is, perhaps, the commonest expedient in railway shops when this can be done without disturbing a whole battery of tools. This, of course, involves no reconditioning of the inadequate machine and a minimum of disturbance to the workings of the shop in many cases.

The purchase of supplementary machines,—as grinders—to effect finishing operations and relieve antiquated or crippled lathes of part of their work; is sometimes resorted to, and this measure also, causes little operating disturbance in the shop as a whole; but does increase the capital account and operating costs of the whole shop.

These measures are palliatives rather than remedies. The remedial measures are confined to a complete replacement of the inadequate unit of a rehabilitation of it to a point where it can again function satisfactorily.

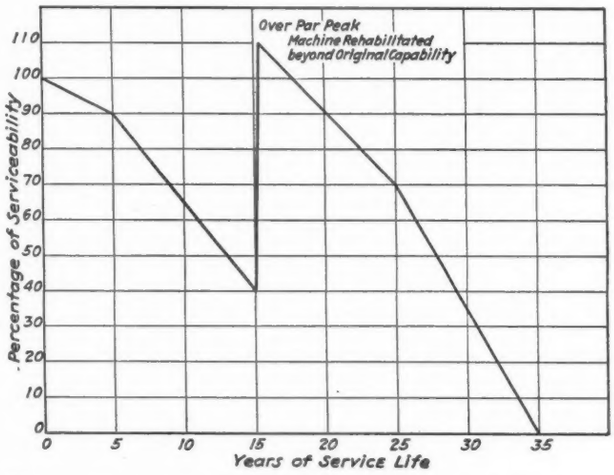


Fig. 3—Curve showing effect of over-par rehabilitation to offset inadequacy

Even the usual, safe generalities, "Disturb the capital account of the shop as little as possible," and; "Do that which promises the greatest return for the least outlay," offer only starting points for any analysis of a specific problem.

Depreciation as a basis for budget requirements

It must be noted again that we are prone to regard the purchase of a new machine as a pure addition to the capital invested; when in reality only the excess of its cost over the first cost of the retired unit may be properly added to the investment account. That is; if we replace a lathe costing originally $1,200 with a lathe costing $1,500, only $300 should be added to the total investment in shop machinery. The bookkeeping entries involve a crediting of the investment account with $1,200—i.e. a "writing off" of the old machine and a debiting of the account with $1,500, the cost of the new unit.

Here is where the major disturbance begins and ends in the railway shop world. The old machine is not retired but is continued in service (usually at original value on the books) either by transfer to a point where this service is of an intermittent nature as in a roundhouse; or else, by a readjustment of machine operations within the shop where the replacement occurred. In either event the total machinery account is increased by the full cost of the replacement unit.

We can now begin to make a summation and analysis of probabilities drawn from statements in the foregoing paragraphs.

It is now possible to obtain a fairly accurate separation of the shop machinery investment account of any carrier from the total investment, by consulting the Valuation Order No. 8, inventory totals. In general this account (No. 44), will be found to be about five per cent of the total capitalization of the road and its equip-

ment. Probably this figure is a little higher than the average for the Class I roads. If the depreciation of the units coming under this classification is accepted as four per cent per annum, then 4 per cent of five per cent, or two-tenths of one per cent of the total capital account, should serve for Account 44 budget requirements yearly. This is an average figure, and its application is based on the presumption that the original engineering in equipping the shop or shops, was sound and that the shop facilities were kept balanced with motive-power repair requirements. In other words, it does not include any allowance for increasing the investment in shop machinery, but merely provides for keeping the property represented by the present investment up to date.

If such a balance has been maintained it will be fairly obvious in any shop where to draw the line between replacements and repairs. That is, there will be some obviously old and inadequate tools needing replacement, but no accumulation of worn out units. Where funds are available from earnings and where shop maintenance has been treated with the consideration which it deserves, the writer would say that 90 per cent of the

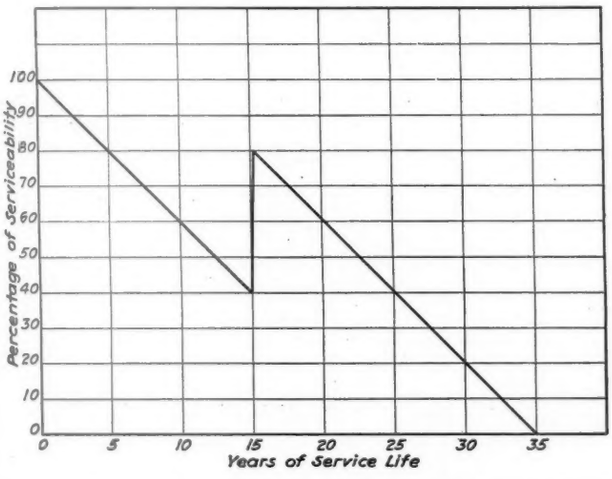


Fig. 4—Illustration of a typical service life and maintenance curve

total operating charges to shop machinery maintenance ought to be used or reserved for replacements, and 10 per cent expended in shop-made repairs, normal and emergency. Even this distribution,—unbalanced as it may seem at first glance,—fails to provide for fluctuating market prices, for progress of invention in machine-tools, etc., by at least as much as is allocated for repair expenditures within the shop.

But all too often, even on railways of proved earning capacity, depreciation and maintenance,—especially as they affect the lesser accounts,—have received scant attention or no attention at all. This condition requires no extraordinarily keen vision to detect. Any mechanic worth consideration as a machine shop foreman, should be able to determine on short acquaintance whether any particular shop is suffering from general under-maintenance or inadequacy and with promotions coming from the ranks, such a man will usually be familiar with the history of the maintenance policies pursued in the past by the management.

Now if it is impossible, or has been usually impossible in the past to obtain replacements, but if the road has met its fixed and operating charges with comparative ease, or even with some little difficulty, the first expedient which will occur to an executive responsible for shop maintenance and administration, is a machine reconditioning program which will at least maintain shop adequacy.

Such a procedure is defensible only on the grounds that it is necessary and possible on a non-dividend paying road; and even then only after presentation of a replacement-budget program to the department heads. After exhausting these measures, it is mere justice to employer and employee alike to adopt such measures as offer in some degree an offset to depreciation.

Does it pay to modernize machine tools?

What follows must be read, not as a specific recommendation, but merely as a summary of personal experiences and personal policy. Keep in mind the fact that we are dealing with arbitrary policies and ever-changing situations.

Theoretically, at least, it would be possible to arrest the downward slope of the depreciation curve of Fig. 1 at any point by the application of major repairs or entire new parts to any machine tool and by the expenditure of enough money bring the whole machine to an even higher state of serviceability than it possessed when bought new. This is not altogether a theoretical absurdity, since by the application of steel gearing, taper, or other special attachments not originally fitted to the machine, heavier driving mechanisms, larger bearings for the main wearing parts, etc., we could bring to a machine such as the inadequate piston lathe previously cited, service possibilities never intended by the designer and builder and much in excess of the builder's original guarantee.

Practically, of course, it is impossible to reach such a state of increased value because of the element of metal fatigue inherent in all mechanisms. Temporarily at least, one could attain an "over-par" peak in the service-life curve as shown in Fig. 3.

This would seem to be an argument for the selection of the oldest machines the serviceability curve of which was descending not on a normal four per cent slope as in Fig. 1, but on a more nearly vertical line as in Fig. 2; because any expenditure for betterment work would produce a greater relative restoration of service value. It must be kept in mind that these curves represent service units and not dollars and cents values; but that to afford some method of measurement for the more or less intangible service unit it has to be translated into terms of dollars and cents.

As an illustration of this statement, consider a lathe originally costing $1,000 and depreciated to a point where repairs costing $400 are necessary to relieve a condition of inadequacy. Now without equating the $400 by means of yearly price indices or other devices, to the amount it would have been in the year of original purchase; we translate it into service units directly. Thus, $400 is 40 per cent of $1,000; therefore, we are restoring 40 per cent of the original serviceability of this lathe. The total of the remaining service units plus the restored service units is, naturally, pure conjecture; but we can approximate it in some degree by the use of the curve in Fig. 1 by selection of that year in the service life in which the machine was repaired. If this reconditioning occurred at a point 15 years after the purchase date when normally only 40 per cent of the original service units remained in the machine, then a restoration of the equivalent of 40 per cent of the original serviceability would bring the curve back to the 80 per cent, or 20 years' service expectancy, as in Fig. 4. This new service expectancy added to the years of

service already credited to the machine would indicate a total service life of 35 years at an outlay of $1,400 if no further repairs or renewals were necessary and would seem to be rather more economical than the purchase of a new machine as a replacement unit at $1,400 and with a normal service expectancy of twenty-five years or more.

Of course this difference in favor of reconditioning is only seeming; since the replacement machine would have the same rehabilitation hazards and possibilities as the original tool, with the same consequent service-life extension, and in addition would be entirely modern in design.

When to repair and when to abandon machinery

But we are discussing a policy of rehabilitation rather than excuses for it and must get on to consideration of when it is advisable to repair and when to abandon.

Purely from past shop experience and as an offset to inadequacy of shop facilities, the writer adopted the following general principles as a policy basis.

First—Collect and summarize the machinery history and make a card index of this data with an individual card for each machine with all usual inventory information on the card, plus such repair records as seem pertinent.

Second—Determine by inspection whether the condition of the machine is normal or sub-normal as compared with the theoretical condition indicated on the service-life curve in Fig. 1. If a reconciliation of the condition disclosed by inspection and the condition indicated by the elapsed life of the machine show a service expectancy of 10 years or more (40 per cent of original service-life) that machine shall be considered to be at the lowest point in the curve at which major repairing should be attempted. Below this point a readjustment of the work assigned to that particular machine would seem to be preferable.

Third—Make even minor emergency repairs to very old machines from forgings rather than castings. These forged parts may be salvaged from a scrapped machine and used to advantage elsewhere and involve no pattern costs.

Fourth—Do not attempt too radical changes in adapting an old and useless machine to other service. In a few desperate cases lathes have been set vertically and used as upright drills for light work by replacing the tail center with a small square table and using the tail center adjustment for feeding the work to the drill held in the spindle. While the writer has occasionally resorted to such measures, he is firmly convinced that their detrimental effect on shop morale more than offsets any benefit derived from them.

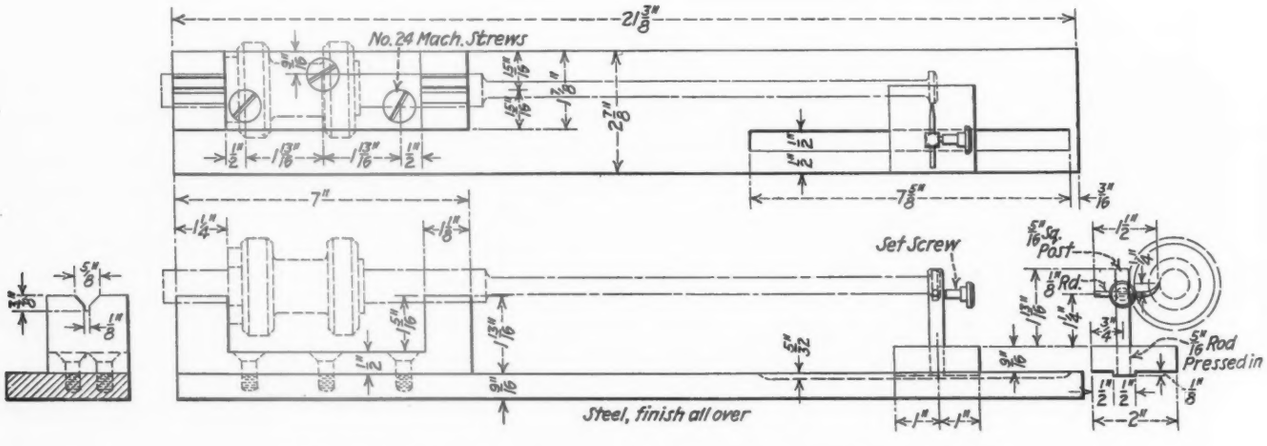
Fifth—Keep machines of the widest range of usefulness in serviceable condition in preference to those whose functions are more limited. Ordinarily, this means the heavier machines which can be used for light work if an emergency arises.

In the foregoing nothing has been said about the disturbing factor of uselessness. Fortunately, nothing need be said about it because railway repair shop operations are so varied that it may almost be stated as an axiom that no machine tool need be retired from railway service on account of the disappearance from the shop operations of the work for which the machine was primarily intended.

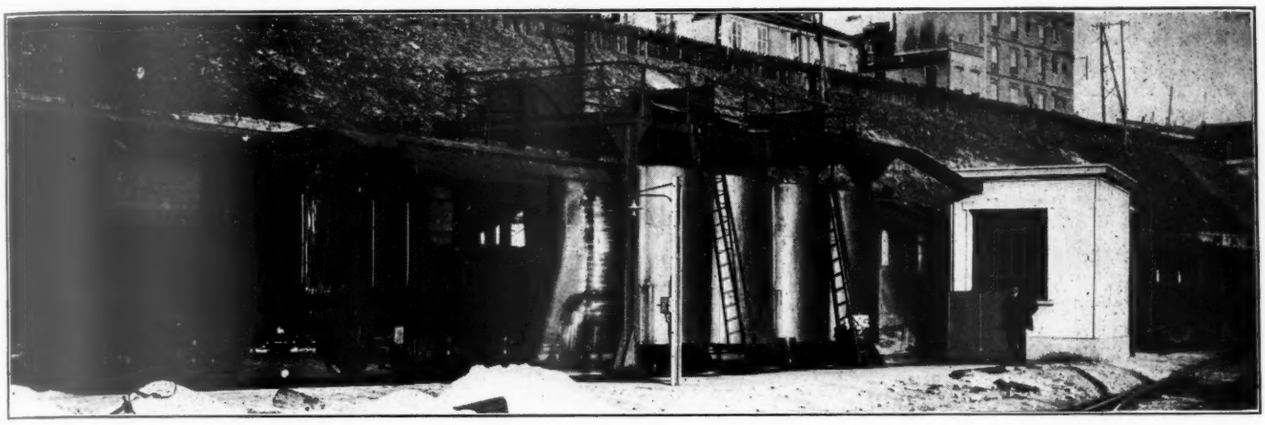
Reserved for the last, stands the most important axiom in maintenance work—Don't let it accumulate.

Testing device for reversing valve rods

A BENCH device for testing the alinement of air compressor reversing valve rods is shown in the drawing. It is so constructed that it can be used for reversing valve rods from any type or size of locomotive air compressor. It is of simple construction, consisting essentially of three parts, namely, a steel base, 2⅞ in. wide by 21⅜ in. long; a support on which the reversing valve rod rests, and an adjustable post provided with a pointer which is used to ascertain the amount the steam end of the reversing valve rod rotates off center. The lugs of the support are provided with vee-shaped grooves, so that the reversing valve rod will always rotate on center regardless of its diameter. Provision is made for moving the post along the base to suit the length of the reversing valve rod, as shown in the drawing. The end of the pointer is set so as to touch the end of the rod and is held in position by means of a set screw. Alinement is determined by rotating the rod by hand and observing any variation in the contact between the end of the pointer and the reversing valve rod.



Device for testing the alinement of air compressor reversing valve rods



Car washing machine of the Paris, Lyon & Mediterranean in operation

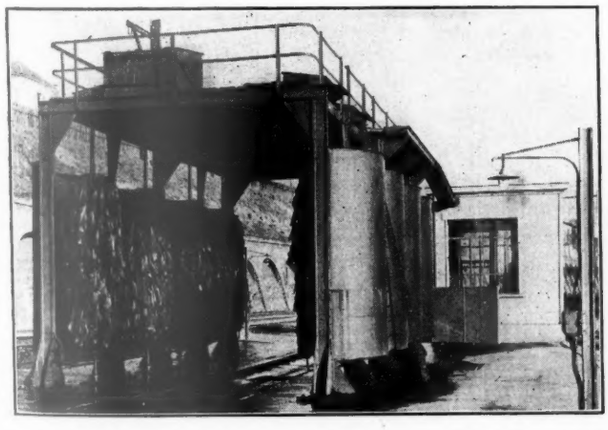
Cleaning passenger equipment

A description of the car washing plant used by the Paris, Lyon & Mediterranean at its Bercy-Conflans yard

By Monsieur Chambon

Principal engineer of equipment, Paris, Lyon & Mediterranean, Paris, France

FREQUENT cleaning is the only way by which a railroad can expect to maintain the good appearance of its passenger equipment. This, of course, means a considerable problem for any railroad such as the Paris, Lyon & Mediterranean which owns and operates a large number of passenger cars. Any attempt to keep a large number of coaches clean by the usual



The control cabin is shown at the right of the car washing machine

method requires a large number of employees which, together with a considerable amount of cleaning material and equipment necessary for each employee, makes the cost of labor and material for cleaning high.

Because of this expense and of the time involved during the process of cleaning, the railroad company decided to avail itself of a large yard at Bercy-Conflans, located near the Paris terminal station, and install a car-washing machine which would give the exteriors of the cars a more thorough cleaning than could be done by hand and, in addition, gain considerable time in the performance of the work itself.

The type of car washing machine is similar in general design to a machine built by the Eastern Railway and placed in operation at its yard at l'Ourcq, just outside the city limits of Paris. There were, however, a number of changes and modifications made in the detail design, such as the pumps and electric equipment, to meet certain local requirements at Bercy-Conflans.

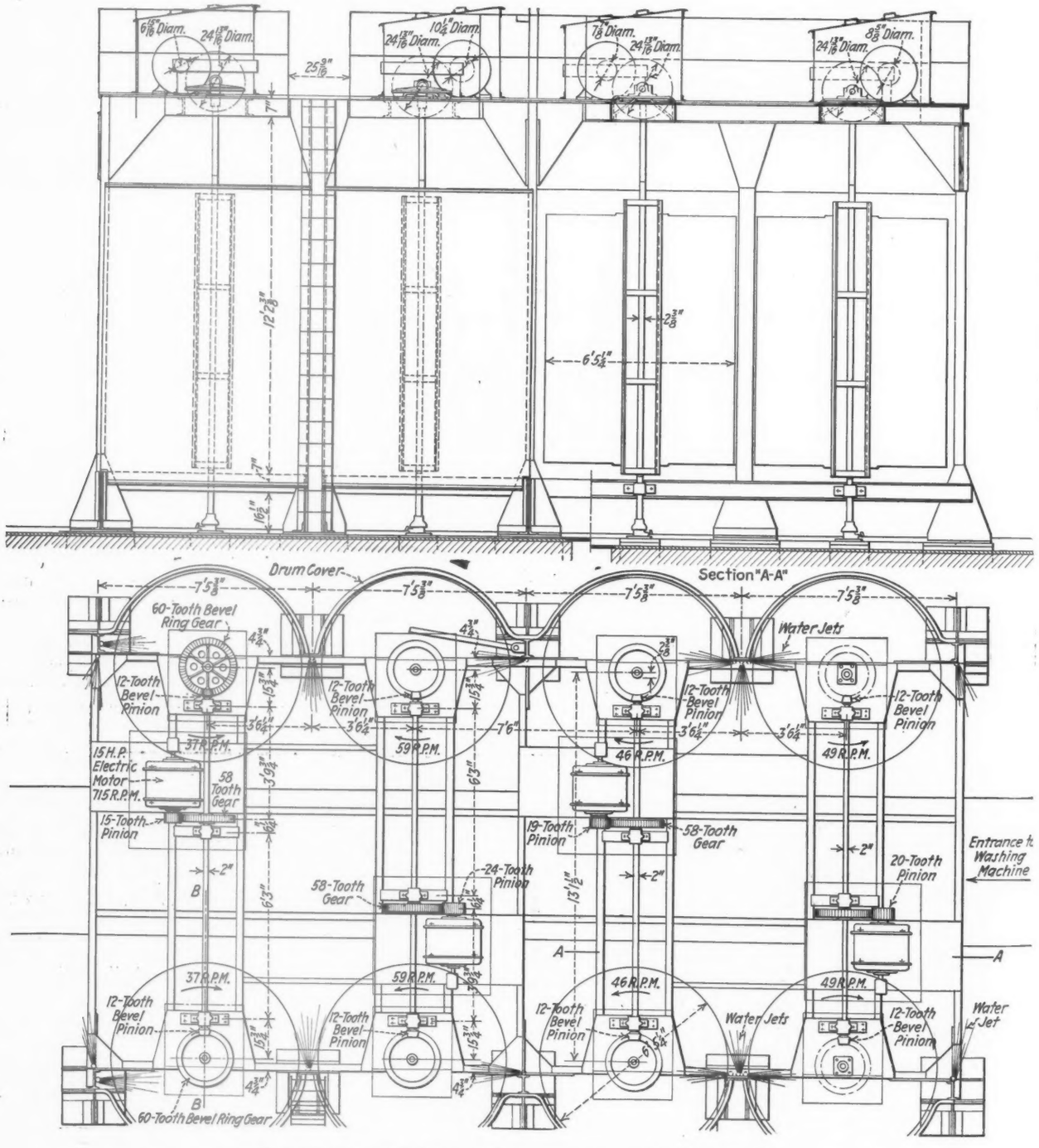
The washing machine

The washing machine built and installed by the P. L. M., is electrically operated and consists essentially of eight vertical brush drums arranged in pairs, one on each side of the track; pipe connections for conveying and spraying the water; two centrifugal water pumps, and a building for housing the equipment. A general view of the washing machine is shown in one of the illustrations and the general layout and dimensions are also shown in one of the drawings.

Four drums are placed on either side of the track as shown. The cars are run through the machine in the direction indicated by the arrow shown on the drawing. The first pair of brush drums rotate in the direction shown at 49 r.p.m., the second pair rotate in the opposite direction at 46 r.p.m., the third pair rotates in the same direction as the second at 59 r.p.m., while the fourth pair rotates in the same direction as the first at the rate of 37 r.p.m. Each pair of drums is operated by a 15-hp., 715 r.p.m. electric motor. Nozzles for spraying water on the drums and on both sides of the cars are located at strategic positions between the brush drums as shown in the general drawing. Suitable drains are provided in the floor of the washing machine structure for carrying away the water.

The detail construction of the brush drums and the

method of securing the cloth strips to the drums are shown in two of the drawings. Each drum is provided with 512 cloth strips, 2¾ in. wide by 25½ in. long. The cloth is similar to that used for upholstering passenger car seats. It is sewed in four thicknesses for each strip, and the strips are secured to the 1⅜-in. by 1⅜-in. angles



Plan and side elevations of the passenger car washing machine

riveted to the drum with a ⅜-in. bolt and ¼-in. plate, as shown in the cross section drawing of the brush drum.

The brush drums

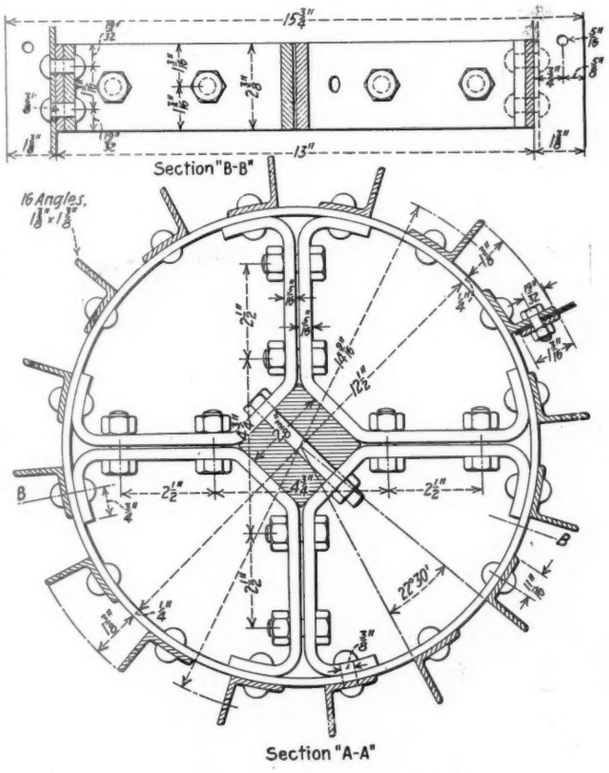
The brush drums are of cylindrical construction, 9ft. 3⅜-in. high by 13 in. in diameter. They are mounted on a 2⅜-in. shaft which pivots on a ball thrust bearing, the detail construction of which is also shown in one of the drawings. The upper end of the brush drum axis is carried in an ordinary friction bearing, and a friction bearing of the same type is placed directly beneath the drum to reduce vibration.

The direction of rotation of the four pairs of drums has been worked out to secure a maximum of cleaning efficiency. The first pair of drums, it will be noted, revolve in a direction such that the cloth strips rub the cars in the direction opposite to which the cars are moving. The second and third pairs of drums rotate in the direction the cars move. This arrangement allows the strip to wipe out the angles of the windows and window

frames and protruding parts of the car, such as grab irons, handles, etc.

The second pair of drums revolves a little slower than the first pair and the third pair rotates at a speed somewhat higher than the other three pairs of drums. The fourth or last pair rotates at the lowest velocity. This divergence of speeds is intended to make it possible to have the strips on each drum properly wipe the entire side of each car. The first pair of drums turn a little faster than the second pair of drums. This is necessary due to the fact that the first two pairs of drums must remove the bulk of the dirt while the third and fourth pairs must remove the most obstinate particles of dirt. The lower velocity of the fourth pair accomplishes the latter purpose quite effectively.

The electric motors for driving the drums are housed in separate boxes made of steel plate to provide shelter from the rain and spray from the nozzles. Easy access



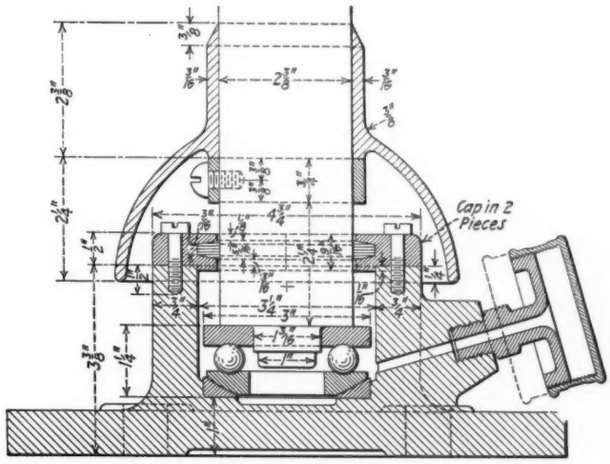
Cross section of the brush drum

is provided to the motors and other equipment located on the top of the washing machine by means of the ladder shown in the end view.

A 1,100-lb. capacity jib crane has also been provided to remove or replace the motors or other equipment in case of repairs. Covers are also provided to prevent water from the brush drums spraying outside the washing machine structure.

Spraying the cars and brush drums

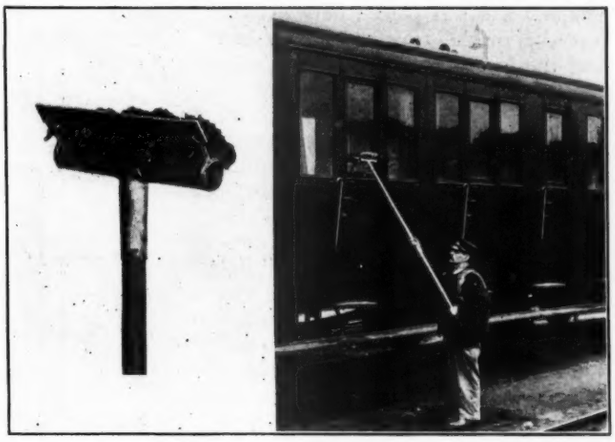
Both sides of each car are subjected successively to the action of eight sprays, four on a side, as it moves through the washing machine. The spray nozzle is a ¾-in. pipe placed vertically between the brush drums, as shown in one of the illustrations, and is 6 ft. 6 in. long. The top of the pipe is approximately 9 ft. 9 in. above the rail, to suit the P. L. M. equipment. Each of the spray nozzles or pipes are drilled with 41 holes 3/32 in. in diameter and water is distributed to these nozzles under a pressure of slightly over 78 lb. per sq. in. by means of centrifugal pumps. In addition, provision has been made for the spraying of each brush drum by means of a single spray nozzle. The spray nozzles used on the outer drums have the same number of 3/32-in. holes as those used



Ball thrust bearing on which the brush drums rotate

for spraying the cars, but the nozzles used for the second and third pairs of drums have only 21 holes. Water for the brush drum spray nozzles is obtained direct from the shop water supply system which has a pressure of about 28 lb. per sq. in. Two valves are provided to drain the piping system in cold weather to prevent freezing.

Summarizing the washing process; when a car moves into the washing machine, each side is first washed, then rubbed, then washed a second time, rubbed, washed,



Rubber strip and polisher used for wiping the windows

rubbed, washed, rubbed and rinsed as it leaves the machine.

The control and operating equipment

All of the control and operating equipment is located in the control cabin at the left of the entrance to the washing machine. The two centrifugal pumps are driven by individual 24-hp. electric motors and have a capacity of 440 gal. per min. Either one of these two pumps can supply sufficient water to operate the machine.

The object in having two pumps is to have a spare available in case one should fail.

In the interior view of the control cabin, at the left foreground is a circuit breaker and directly at the rear are six controllers, four of which control the brush drum motors, and two the centrifugal pump motors. The hand wheel shown in the foreground permits through its single operation the simultaneous setting in motion of the four motors driving the spray drums and one of the motor-pump group. The lever shown on the right allows through its single operation the opening or closing of the low pressure water supply to the brush drum spray nozzles and the high pressure water supply to the spray nozzles for washing the cars. All of the motors are 3-phase, 220 volt, 50 cycles, of the induction type.

How the washing machine is used

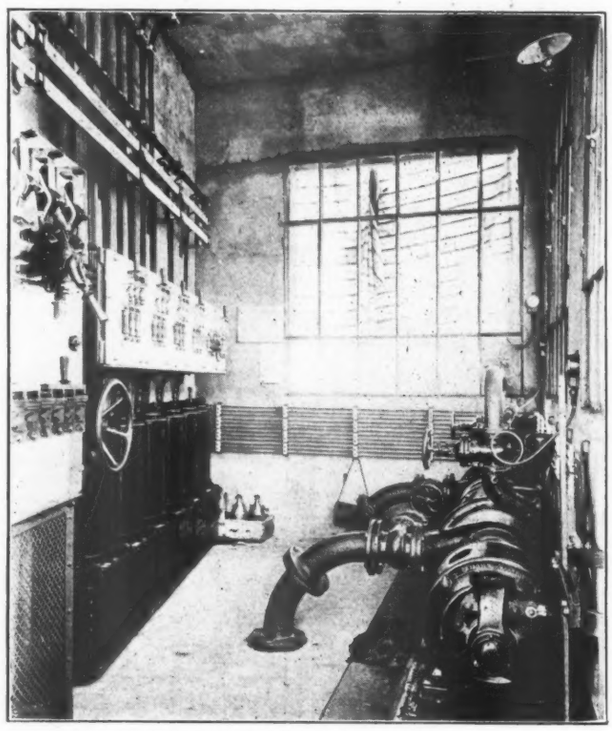
The dimensions adopted for the brush drums and the variable speeds at which they rotate were selected to suit all of the different types of passenger equipment used by the P.L.M. A large number of the passenger cars, especially those used in suburban service, are equipped with numerous side doors, each of which has a lock or latch handle projecting. There was good reason to believe that these projections would cause premature wear of the cloth strips, or that some of the fixtures would either be torn off or bent, but experience has shown that these projections will cause no trouble.

The procedure used for washing a train of cars is as follows: first, an inspection is made to see that all the doors and windows are closed tight. If, during this inspection, the inspector notices that a window pane is very dirty, he scrubs the window with a brush and a little powdered pumice stone. This preliminary scrubbing is usually done on from 7 to 8 per cent of the total window area on the cars passing through the machine.

After this work is completed, the train is run through the washing machine by a switch engine at a speed of from two to three miles per hour. Usually a car is placed between the last car in the train to be washed and the locomotive.

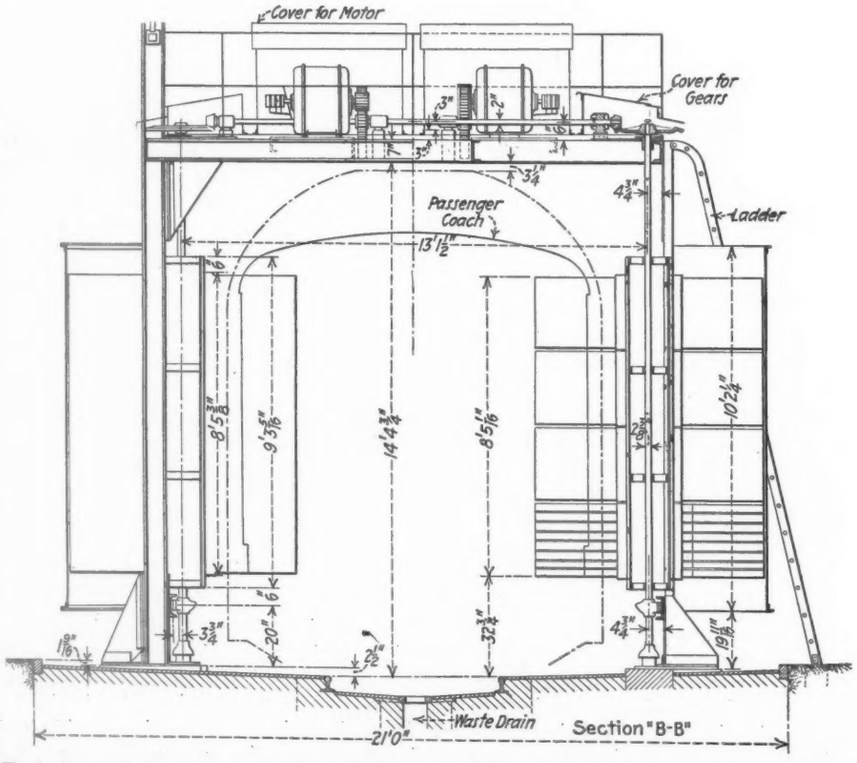
When the first car is about to enter the machine, the operator in the control cabin starts the brush drums and pump motors by turning the hand wheel, and then turns the water into the spray nozzles by moving the lever. The train continues through the machine until the last car has been washed. The entire operation, including the starting and stopping, requires about six minutes. The cars are not wiped off, the water being allowed to evaporate. The ends of the cars and vestibules are washed by hand. The window panes are rubbed down with a rubber strip, the construction and use of which is shown in one of the illustrations.

This type of machine can be used in cold weather if the temperature does not fall more than 6 deg. F. below zero. Below this temperature the cloth strips become stiff and here is liability of their being stuck together so that they will not function. There is also danger in the force of the blow of a frozen strip breaking the window panes or marring the finish of the cars. However, thorough washing in cold weather is practically out of the question regardless of how the work is done, due to the fact that ice will form on the steps, making them unsafe for the traveler.



Interior of the control cabin

The cars used in through train service are washed



End elevation of the car washing machine used by the Paris, Lyon & Mediterranean

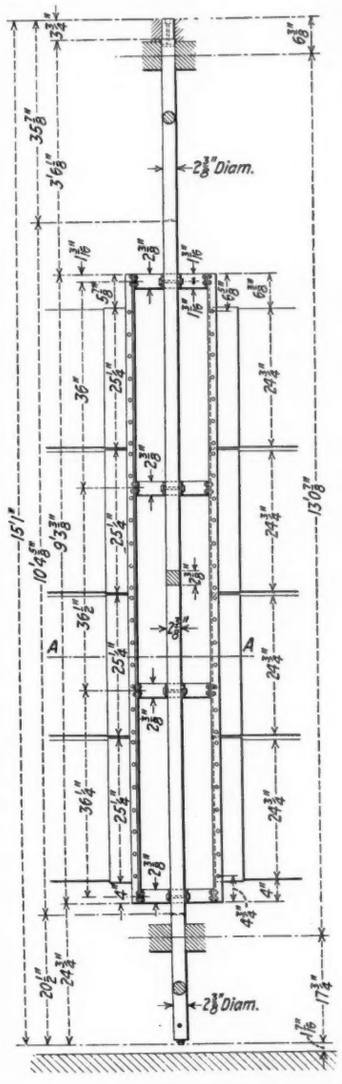
after each round trip and the suburban cars are washed every day.

Cost of building and operation

The washing machine uses about 15,852 gal. of water per hour at 78 lb. pressure and 7,926 gal. at 28 lb. pressure. The power absorbed by each of the brush drum motors varies between 4½ and 6 kw. according to the type of cars being washed. The power used by one of the centrifugal pump motors amounts to about 10 kw.

The total expense involved in installing the washing machine, including the foundation, piping for water and wiring for electric power, amounted to about $96,250 of which $31,700 was for machinery. The spare parts purchased included a complete pump and motor assembly and one motor for the brush drums.

At the present time the machine washes 30 trains per day and it can easily handle from two to three times that number. Previous to the installation of this machine it required a total of 40 employees to wash these trains by hand. Only 10 employees are now required who wash the ends and vestibules, and three men who inspect the trains wash the excess dirt from the window frames, operate the machine and operate the locomotive that handles the trains. This installation has accomplished a net saving of 27 employees, or 67.5 per cent of the labor used before placing this machine in operation. The gross saving will undoubtedly be larger as the trains increase in number and become longer.



Detail construction of the brush drum

DIXON CENTENNIAL.—The business philosophy of the Dixon Company is interestingly set forth in a recital of business victories and tribulations under the title of "A tale of yesterday, today and tomorrow," written by Floyd W. Parsons on the occasion of the one hundredth anniversary of the Joseph Dixon Crucible Company, Jersey City, N. J.

CHROME NICKEL STEEL IN SPECIAL TRACK WORK.—A scientific and practical discussion of the characteristics of chrome nickel steel adaptable for use in equipment subject to unavoidable abuse and hard wear, is contained in Bulletin No. 10 issued by the International Nickel Company, 67 Wall street, New York. The results of more than six years' use by the Milwaukee Electric Railway and Light Co. are also given in this eight-page bulletin.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Charges for changing triple valves justified by original records

The Union Railway rendered to the St. Louis-San Francisco a bill for $351 which included charges for cleaning air brakes on S.L.-S.F. car No. 124711. The owner took exceptions to the charge, especially to changing triple valves, claiming that the repair card did not state the reasons for cleaning the air brakes and requested cancellation of the entire charge covering the work performed on this car, basing its contention on the fact that the repairing line refused to forward the original repair cards. The Union Railway insisted that it did not have to send the owner the original record showing the repairs made to the car. Circular DV-218 was cited and interpreted to mean that the billing road must have its repair records open and available at all times for the inspection of the car owner, but does not have to forward them to the owner. The owner further contended that the repairing line should be required to cancel its entire charge for air brake work on this car in accordance with Rule 90 as the repairing line had no occasion for changing the triple valve on this car or cleaning the air brakes.

The Arbitration Committee in rendering its decision stated that the original records of the Union Railway show sufficient information to justify the charge. Therefore, the contention of the owner was not sustained.—*Case No.* 1452, *Union Railway Company vs. St. Louis-San Francisco.*

Internal pressure causes tank head to rupture

While Union Tank Car No. 1151, loaded with crude oil was being switched in the yard of the Indiana Harbor Belt on April 30, 1923, there developed a fracture in the tank head at the "A" end, at the bottom flange approximately 43 in. in length and ¼ in. in width. The handling line maintained that the damage to the tank head was due to internal pressure, stating that the car had not been switched at a speed of over two to four m.p.h., and when the coupling was made the speed had been retarded to about one m.p.h. This speed of movement is supported by the fact that no other damage had been done to the car in question or to the car to which the coupling had been made. The owner contended that the car had been damaged as a result of rough handling.

In rendering its decision the Arbitration Committee stated that "there is no evidence of unfair usage to which the failure of the tank head could be attributed under the rules in effect at the time of the damage. Tests of loaded tank car made during the year 1914 (M.C.B. Proceedings 1914, Volume 48, Part 1) at speeds varying from 8 to 14 m.p.h., the car being switched against other standing cars, produced a maximum of but 11¼ lb. per sq. in. in pressure against the tank head at the time of impact. At such rates of speed the pressures obtained in these tests were less than ⅕ of the standard test pressure (60 lb. per sq. in.) required for tanks. It is obvious, therefore, that the rupture in the tank head was not

produced by high internal pressure in consequence of excessive speed impact, but on the contrary, must have resulted from some imperfection or defect in the metal.

"The argument of the car owner that the fracture could not have been due to internal pressure, 'as the flow of liquid through the fracture immediately dissipates the force of the blow' is questionable because before any undue stress could be transmitted to the tank head, the momentum of the car must be stopped through the draft gear and underframe; furthermore, with the character of lading involved and extent of the fracture, the release of pressure would not, as contended, be such as would be necessary instantaneously to dissipate the force of the blow. The contention of car owner is not sustained."—*Case No. 1454—Indian Harbor Belt vs. Union Tank Car Company.*

Car damaged owing to the lack of rider protection

On June 30, 1925, the Peoria & Eastern advised the Chicago & Eastern Illinois that its car No. 67504 was being held with longitudinal sills broken on account of their badly decayed condition. In order to facilitate settlement the handling line requested that an inspection of the car be made. On July 1, 1925, a representative of the C. & E. I. inspected the car and advised the handling line that the damage to the car was due to switching without rider protection and requested the handling line either to repair the car at its expense or dismantle it and settle for it in accordance with the depreciated value. The correspondence between the two railroads developed the fact that the Peoria & Eastern does not use riders in switching cars at Urbana, where the car was damaged, except in the case of a bad order car, for the reason that in ordinary switching, rider protection is not necessary.

The Arbitration Committee in rendering its decision stated that the car was handled without rider protection and, therefore, according to Rule 32, section D, Item 4, the handling line is responsible and that the decisions in cases 1124 and 1131 were applicable to this case.—*Case No. 1453, Peoria & Eastern vs. Chicago & Eastern Illinois.*

Car damaged owing to three cars in a cut marked "No brakes"

On September 17, 1924, Chicago & Eastern Illinois car No. 65192 was damaged while being switched in the yards of the Indiana Harbor Belt. The I. H. B. requested the C. & E. I. for a disposition of the car under A. R. A. Rule 120. The report of the accident furnished by the conductor in charge showed that out of a cut of four cars, which included the C. & E. I. car, three of the cars were marked "No brakes." The owner contended that the defective brakes on the cars made the handling line responsible for the damage which occurred to its car. The handling line took the position that the cars did not have defective brakes and that the cut of four cars had rider protection and that all requirements of the A. R. A. Rules were adhered to in handling the cut of cars.

The Arbitration Committee ruled that "according to a report of the investigation as to the circumstances under which the damage occurred, the damage was the result of switching a cut of four cars, three of which had defective brakes, these cars being marked "No brakes." This evidence has not been disproved; the statement that there is no record of defective brakes because of no repairs having been made by the handling line or owner is not conclusive. The handling line is responsible."—*Case No. 1455—Chicago & Eastern Illinois vs. Indiana Harbor Belt.*

Removing entire draft gear for lack of repaired parts in stock

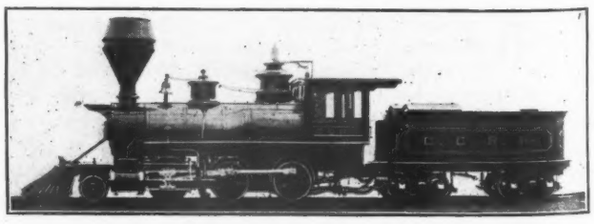
On February 6, 1925, the New York, New Haven & Hartford repaired Darling & Company car No. 1518 by applying one steel draft spring and two follower plates and removing a complete Cardwell G-11 draft gear on account of being broken. A defect card was issued for the wrong repairs and when the repairs were corrected the owner billed the New Haven for labor and material. The New Haven contended that the bill should have been for labor only. The owner contended that when the New Haven failed to repair this gear but removed it from the car, it was liable for the missing friction draft gear under Rule 95 and that Interpretation No. 4 of Rule 88 applies. The New Haven contended that the draft gear in question was broken and not carrying that type of gear in stock, springs and followers were applied and a defect card was issued for labor only. The New Haven then rendered a bill and allowed proper credit for the draft gear removed.

The Arbitration Committee ruled that the bill of Darling & Company should be confined to labor only for standardizing the repairs, on authority of the defect card, on the basis of Rule 88. "All undamaged parts of the gear removed by the New York, New Haven & Hartford must be credited at value new, as contemplated by the rule in effect on the date of repairs."—*Case No. 1456—Darling & Company vs. New York, New Haven & Hartford.*

The grinding of cast iron wheels

On January 24, 1925, the Detroit, Toledo & Ironton applied one pair of 5½-in. by 10-in. reground cast-iron wheels to Carolina, Clinchfield & Ohio car No. 44096, on account of removal of two scrap wheels on the scrap axle. The owner was charged $6.50 for the wheels, plus the charge for a second hand axle and the usual labor. The Clinchfield based an exception to this charge on the grounds that the use of reground or reconditioned cast iron wheels is unauthorized by A. R. A. Rules. The D. T. & I. made the contention based upon its experience in regrinding wheels and the utilization of them that the practice is a safe and economical one and that the bill should have been paid.

The arbitration committee ruled that if the wheels were ground truly concentric with the journal and were not, after grinding, condemnable by the A. R. A. remount gage, they should be considered as second-hand and a bill rendered on that basis is proper.—*Case No. 1458—Clinchfield vs. Detroit, Toledo & Ironton.*



Three-foot gage locomotive built in 1880 for the Colorado Central—15-in. by 18-in. cylinders, and 55¾-in. drivers

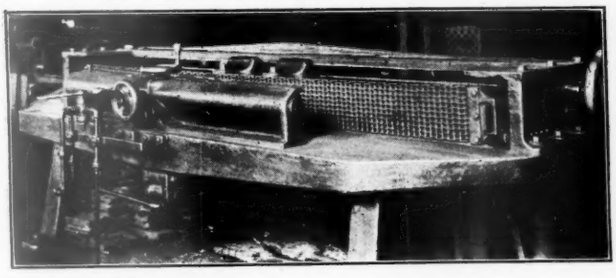
The electrically heated salt bath (covered), the hot water washing tank and the oil quenching tank

The C. N. R. installs spring treating plant

Electric furnace and salt bath for heating and drawing, at Stratford, Ont., shops, are pyrometer controlled

THE Canadian National has recently installed an up-to-date steel spring heat treating plant for the manufacture and repair of heavy elliptical type springs for locomotives and tender trucks at its Stratford, Ontario, shops.

For some time past, it has been appreciated by the officers of the Canadian National system that the method of heat-treating heavy railroad springs has not been sufficient to meet the demands of modern power and that the

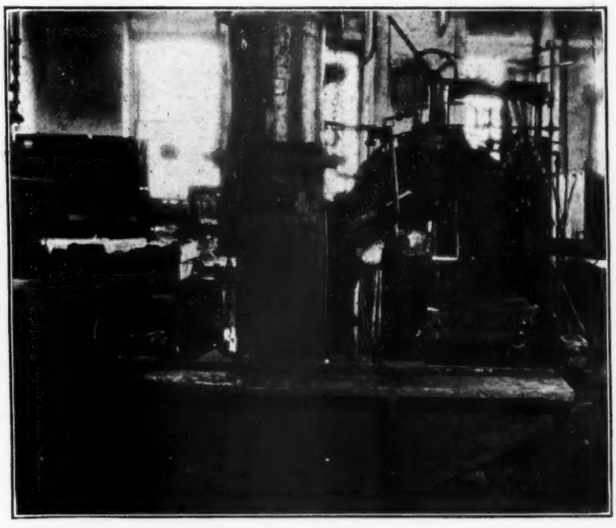


The spring plate bending machine

railways are behind the automobile industries in this respect. The question of improving the present practice—quenching the formed leaves of a spring in oil and then drawing them out at a temperature that will just ignite the oil remaining on them from the quenching bath—has been given considerable attention, with the result that the new plant was equipped with electric furnace, oil quench bath and salt bath draw.

The new plant had to be installed in the same part of the building as the old plant and it was thus necessary to so interlock the operation of taking out part of the old plant and installing the new plant as not to interfere with the continuous output of the spring shop.

An increase in the output of the plant, a much better



The spring testing machine, with the banding machine in the background

and more uniform spring, as well as a great reduction in failures are expected. The first two results are already apparent.

The old plant consisted of a steam hammer and fur-

nace, a disbanding machine, a forming machine and two oil furnaces (one of them double), two benches for assembling springs, three water-cooled oil tanks, a banding machine and furnace, a spring testing machine and an oil tank for oiling the springs after assembling. The steam hammer is used for forming new bands and for any necessary repairs to old bands which can be used again. The three water-cooled tanks were used for quenching the leaves after forming, from which the leaves were withdrawn at the temperature required to flash the oil adhering to them.

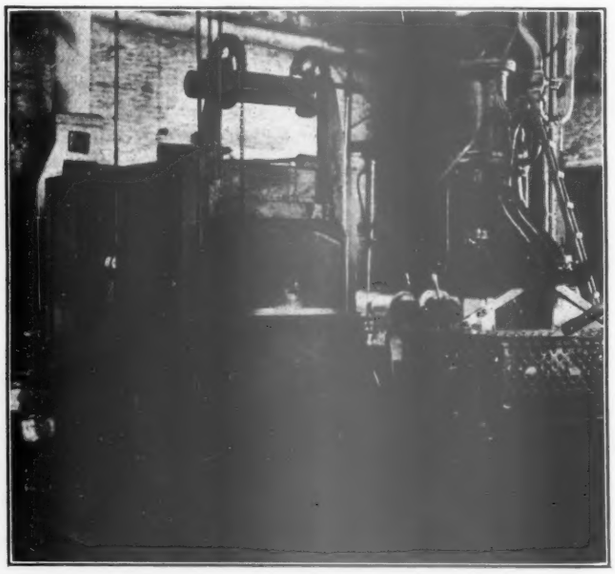
New plant

The spring leaves are now heated for quenching in a single end electric furnace 24 in. by 24 in. by 72 in. in length, to operate at 1,850 deg. F., 60 kw. capacity, using 25-cycle 3-phase, 110-volt, a. c. current. The door is operated by a foot treadle. The elements are located at the top and bottom of the furnace. The bottom elements are located under the two-section floor plate and are thus protected from injury. The top elements are suspended overhead and are clear from the spring leaves by a sufficient margin to avoid injury from loading and unloading the furnace.

The furnace is equipped with a graphic recording pyrometer and automatic control equipment. Leeds & Northrup instruments are used on both the electric furnace and the electric salt bath.

The instruments, switches and control equipment are all mounted on three slate pipe mounted panels. These panels are located away from the heat of the furnaces and will be well protected from dust, etc.

A new, water-cooled oil quenching tank has been installed complete with sheet steel trays for holding the



The electric heating furnace, with the water-cooled oil quenching tank in the right foreground

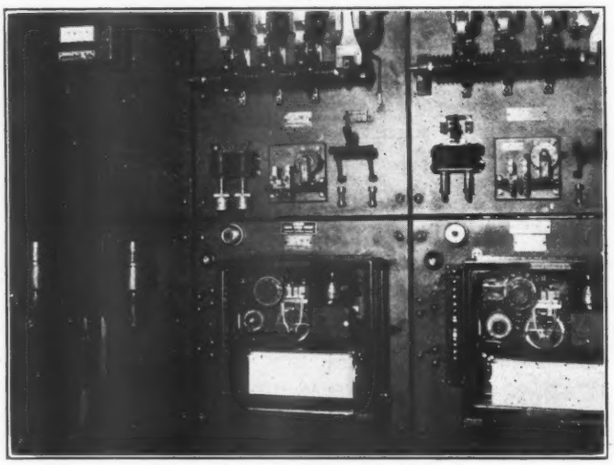
spring leaves when quenching and for draining the oil off after quenching. These trays are withdrawn by means of an air hoist and swung round to the steam-heated washing tank which is alongside and readily accessible.

Next to the washing tank is an electrically heated salt bath 36 in. by 36 in. by 72 in. in length. This salt bath has automatic temperature regulation and is equipped with a graphic recording pyrometer. The sheet metal trays are used to immerse the spring leaves in salt bath.

Provision is made for washing the salt off the leaves after the drawing operation.

The plant is being equipped with all necessary trays, racks and hoists to handle the springs with the least time and labor at each step of the process.

One of the old oil furnaces is being used for heating the steel for forming the leaves. The old forming machine is used as before. The disbanding and banding machines are also used, with their respective furnaces,



The switchboard which controls the electric furnace and salt bath—Recording pyrometers are shown at the bottom

as are also the spring testing machine and the oil tank for oiling the springs when banded.

Summary of the new process

The old spring is disbanded and any broken leaves are replaced with new ones formed to fit their respective places in the old spring. The whole spring is then put into the electric furnace and brought up to a temperature of 1,650 deg. F. and left there until well soaked with the heat, depending upon the size of the leaves for the time of soaking and the carbon content for the temperature the furnace is brought up to. The complete spring is all treated at the same time, whether it is an old one of partially replaced leaves or a complete new spring. This causes somewhat more work at first but in time will mean that all the springs will have been properly heat-treated by the new method.

The leaves are then brought out and quenched in Houghton No. 2 soluble quenching oil. After being cleaned they are put into the salt bath, which operates at a temperature of 800 deg. F. for the carbon steel spring leaves, and at a somewhat higher temperature for alloy steel springs.

The springs are then washed, banded, tested and oiled.

A series of Photomicrographs are also included herein to show the structure of the formations in the steel and the stages in which they take place. These are described separately under each photograph.

Heat treating tests

The following are some of the tests carried out from time to time in connection with the study of springs by the assistant test engineer of the railroad.

Test No. 1—*Carbon spring steel*—Specimen was a spring leaf 4 in. by ½ in. by 3 ft., with the following chemical analysis:

C.	Si.	S.	P.	Mn.
0.96	0.045	0.043	0.038	0.44

The Brinell hardness as rolled was 260 to 280, and, as hardened, 340 to 360. The plate was heated to 1,650 deg. F. and formed. It was then heated to 1,500 deg. F. and quenched in oil, then reheated to 850 deg. F. The camber test resulted as follows: At rest, 2¾ in.; once pushed straight, 2⅝ in.; then six times pushed straight to ⅝ in.

Test No. 2—Silico-manganese spring steel—Specimen was a spring leaf 4 in. by ½ in. by 3 ft, with the following chemical analysis:

C.	Si.	S.	P.	Mn.
0.50	1.89	0.033	0.038	0.87

The Brinell hardness number as rolled was 248, and, as hardened, 387. This plate was heated to 1,650 deg. F. and oil quenched; then it was reheated to 850 deg. The camber test was as follows: At rest, 2¾ in.; once pushed straight, $2\frac{9}{16}$ in.; six times pushed straight, $2\frac{9}{16}$ in. The physical tests of this material as normalized and as quenched and drawn are given in the following table:

Physical tests of silico-manganese spring steel

Normalized at 1,650 deg. F.	
Max. stress, lb. per sq. in.	129,920 to 138,880
Yield point, lb. per sq. in.	89,600 to 94,080
Elongation in 2 in., per cent	20 to 15
Reduction of area, per cent	40 to 30
Oil quenched at 1,650 deg. F. and drawn at 850 deg. F.	
Max. stress, lb. per sq. in.	179,200 to 224,000
Yield point, lb. per sq. in.	156,800 to 197,220
Elongation in 2 in., per cent	14 to 11
Reduction of area, per cent	25 to 20

Note—The Bethelehem Steel Company quotes the following figures as to the physical properties of spring steel of the carbon and silico-manganese grades:

	Carbon steel	Silico-manganese steel
Tensile strength, lb. per sq. in.	190,000 to 200,000	215,000 to 225,000
Elastic limit, lb. per sq. in.	130,000 to 140,000	180,000 to 190,000
Elongation in 2 in., per cent	10	10
Reduction of area, per cent	30	25
Brinell hardness No.	388 or less	415 or less

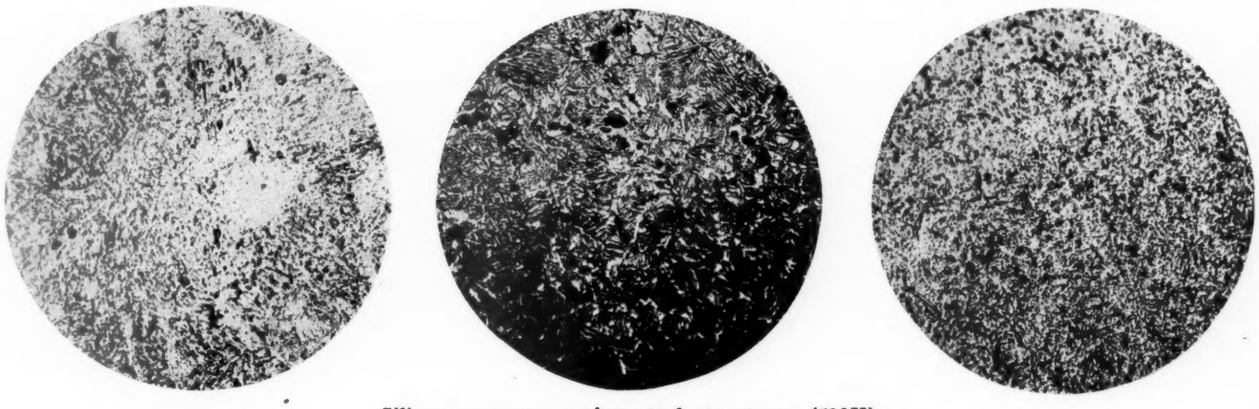
Test No. 3—Carbon steel—Six specimens were cut from one bar of the steel now being used at Stratford, with the following chemical analyses:

Specimen No.	C.	Si.	S.	P.	Mn.
1	0.80	0.17	0.046	0.037	0.80
2	0.80	0.17	0.046	0.034	0.79
3	0.84	0.17	0.048	0.039	0.78
4	0.81	0.16	0.049	0.039	0.79
5	0.80	0.17	0.049	0.037	0.78
6	0.80	0.17	0.049	0.034	0.76

All specimens were previously normalized; that is, air cooled, from 1,600 deg. F., then reheated to 1,650 deg. F. and quenched in Houghton No. 2 Soluble quenching oil, allowed to cool to 100 deg. F. and then reheated to different temperatures ranging from 650 to 800 deg. F., in Houghton No. 275 drawn temp.

The drawing temperatures, Brinell hardness numbers and other physical properties of each of the six specimens, after heat treatment are given in the table on the following page.

The figures in this table give a very good idea of the value of the heat-treatment now being used at Stratford and the value of properly treated springs.



Silico-manganese spring steel structures (500X)

Left: A good structure, quenched at 1,650 deg. F., and drawn back at 850 deg. F.: Brinell 387—Center: This structure, treated by the flash method, differs little from the rolled bar; Brinell 255—Right: A very uniform and fine grain, quenched at 1,650 deg. F., and drawn back at 780 deg. F.

Plain carbon spring steel structures (500X)

Left: A coarse structure, treated by the flash method—Center: A good structure, treated by the flash method, but impossible to obtain regularly by this method; Brinell 350—Right: A good structure uniformly obtainable by the quench and draw back method: Brinell 342.

The Brinell hardness numbers obtained under the old way varied from 290 to 418 and by the new way the results average 340 with a very low range of maximum and minimum resulting from the variation of the carbon and to some extent of furnace operation.

The plant has been in operation for about a month and is giving satisfaction in every way. The service that the newly treated springs will give is being very carefully watched and some slight adjustment may be expected as time passes.

Physical properties of carbon steel drawn at different temperatures

Specimen No.	Drawing temp., deg. F.	Brinell No.	Yield point, lb. per sq. in.	Ultimate strength, lb. per sq. in.	Elongation in 2 in., per cent	Reduction of area, per cent	Elongation in 8 in., per cent
1	650	444	98,919	98,919	2	Nil	1
2	675	387	73,109	136,356	5	1.4	1.5
3	700	387	90,742	163,281	2	1	.5
4	725	351	110,578	192,101	5	2	3
5	750	340	123,040	194,522	12	18.7	4.5
6	800	364	168,033	204,080	14	11.9	5

A very interesting feature in the forming of the leaves is a partial set of master leaves from which any number of some of the most used springs can be made up. All the leaves of one length and shape can be made up at once and then the next length of leaf can be made. This avoids confusion and makes that type of springs practically interchangeable as to the leaves.

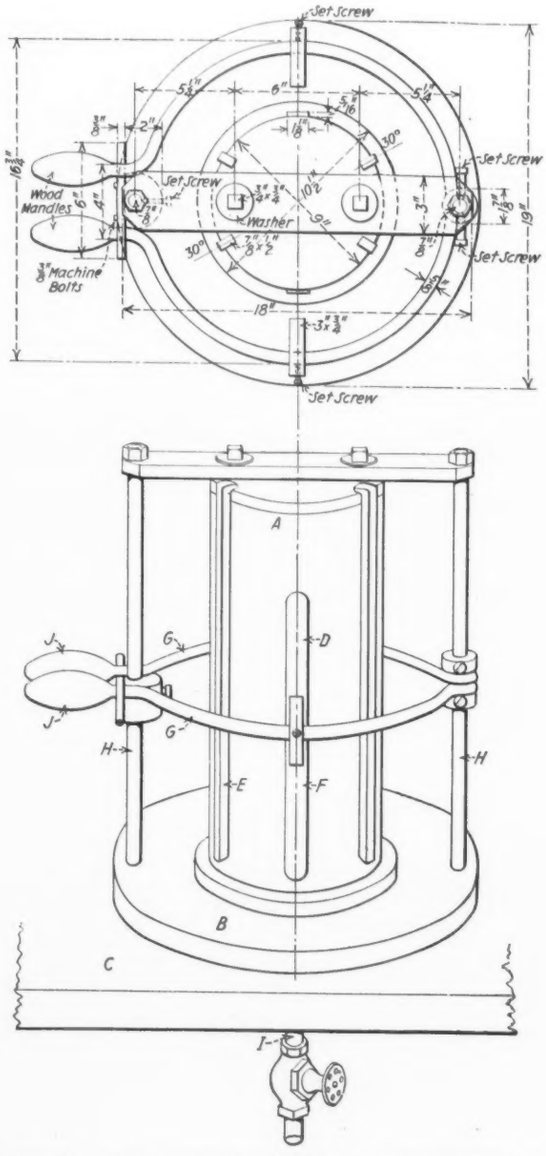
A Brinell hardness testing machine is used for checking up the leaves as they are treated. One leaf from each draw is tested and the work is otherwise watched and checked with the Brinell machine as well as on the hydraulic testing machine.

Mandrel for babbitting locomotive trailer truck brasses

By H. H. Henson
Machine shop foreman, Southern, Chattanooga, Tenn.

ORDINARILY it requires considerable time to rebabbitt trailer truck brasses. It is not necessary to bore a truck brass after it has been babbitted in the fixture shown in the illustration as the casting *A* is made to the size of the trailing truck journal bearing. This casting is cored hollow so that it can be cooled with the water pipe *I* which passes through the table on which the mandrel is set. Castings *A* and *B* can be made as one or separate. The 1-in. diameter rods *H* support the ⅝-in. spring steel rods *G* to which are attached the lugs *D* that hold the brasses in place on the mandrel. The handles on the rods *G* are made of wood. The lugs *E* are hooked over the top of the casing *A* for the purpose of determining the thickness of the brass to be poured. The two edges of the brass are placed on the lugs *E*. The brass is centered on the lug *F*. This lug leaves an oil cellar or pocket in the center of the brass. The fixture is bolted on a bench or some other convenient place. Two brasses can be babbitted at one time.

Two trailer truck brasses can be babbitted at one time on this mandrel



Construction of a mandrel for babbitting trailer truck brasses

BALL AND ROLLER BEARINGS.—The design, manufacture and application of R. & M. ball and roller bearings are described and illustrated in an 80-page general catalogue issued by the Ransome & Marles Bearing Company, Ltd., 17 Victoria street, Westminster, S. W. 1, London, England. A thumb index provides an easy method of reference to all types of bearings listed.

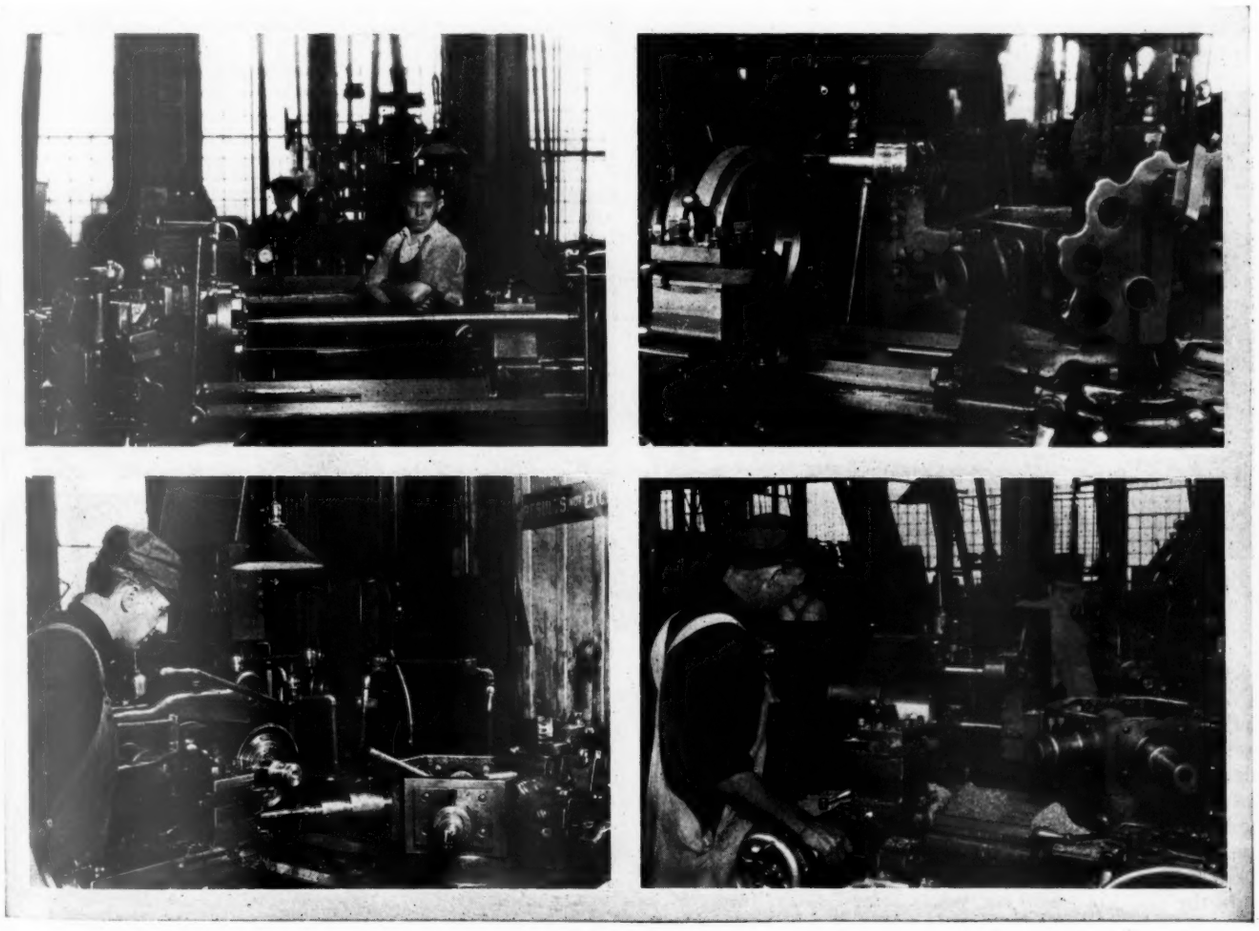
Turret lathes in railroad shops

Suitable for quantity and small lot production—Different types of machines and some of the work turned out on them

By A. C. Cook
Vice-president, Warner & Swasey Company, Cleveland, Ohio

THE railway master mechanic or shop superintendent of today is studying production methods much more carefully than ever before, in order to keep down the cost of repairs going through his shop. He is finding that the first cost of equipment is not the thing to be considered, but that on the other hand, the cost per piece of work completed is the thing to look at. The railroads must spend a certain amount of money to keep their locomotives and rolling stock in serviceable condition and inasmuch as they are compelled to buy shop equipment for this purpose, they are learning that the equipment which, at the start, is least expensive is not always the proper equipment.

The machine tool industry sells its product on the basis of the return on the investment. It is true, of course, that the ordinary machine tool buyer has more of a quantity production proposition than railway repair shops have, but work in the railway repair shops is growing to such an extent that the quantities produced are larger than they were, say ten years ago. Therefore, in some instances a different class of equipment is desirable. However, as equipment in the railroad shops must be changed over from job to job rather frequently, the equipment which is installed must be flexible.



Upper left—Machining a piston valve follower rod; Upper right—Using two turret heads to machine a bull ring; Lower left—A Prosser roller flue expander is a job for the turret lathe; Lower right—Finishing the inside and outside diameters of a bronze rod bushing

The engine lathe has always been one of the old standby machines in every repair shop. This machine is, of course, purchased in various sizes to suit the needs which arise from time to time. For much work, the engine lathe is being gradually replaced by turret lathes, principally because the latter machine is flexible, is capable of

being quickly changed over from job to job and when so changed over, produces the new job in much shorter time than it could have been produced on the engine lathe.

One of the first questions that arises in the mind of the mechanical department officer when selecting new equipment, is the field to be covered by such equipment; that is, the work in his particular shop which would be done on the machine. In the case of the turret lathe, the field might be said to include all parts from castings, forgings or bar stock within certain size ranges, which must be turned, bored, threaded and faced. It will be seen at once that this field is extremely large. All these parts vary in sizes; in fact, the same part may be made in several different sizes, depending on the classes of locomotives to which it is to be applied.

Flexibility of the turret lathe

The present-day turret lathe is such a flexible machine that any of the above kinds of work—that is, castings, forgings or bar stock—may be done with equal facility. Parts made from the bar might include spring rigging bolts, pedestal cap studs, cross head pins, link motion pins, roller flue expanders, staybolt sleeves, whistle stems, air compressor pistons, cylinder head studs, valve stem

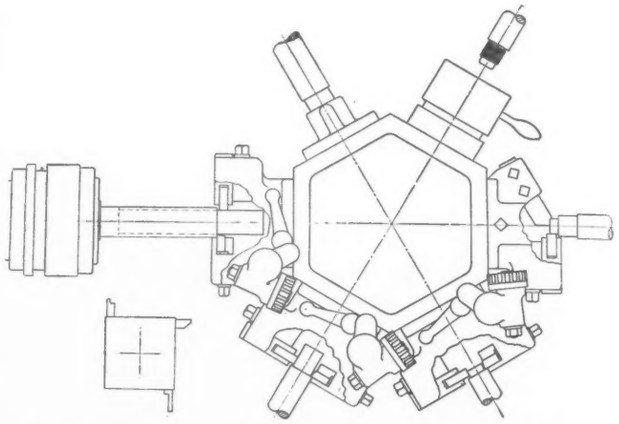
A valve yoke guide can be machined to advantage on a turret lathe

packing caps, eccentric rod pins, valve yoke guides, back end main rod bolts, piston valve rods, as well as studs and bolts of all kinds, whether long or short.

Turret lathes are made in various sizes. The smaller machines are, of course, faster to operate, as the parts are naturally lighter and higher speeds and faster feeds are provided. The speeds and feeds of the larger machines are worked out to cover the best practice on work within the size ranges of these larger machines.

In the chucking field the turret lathe handles bull rings, friction joints, piston valve followers, side rod collars, grease cup bushings, grease cup bodies, stoker pistons, valve caps for air compressors, water glass drain bowls, relief valve butts, steam chest relief valve bodies, angle valve bodies, water glass fittings, gage cock bodies, bronze rod bushings and similar parts. Many parts made from forgings are also handled on turret lathes, usually consisting mainly of bolts and pins which are finished all over.

Naturally the production problems in the large repair shops are different from the problems of the smaller shop. The large central shops manufacture certain parts in quantities for shipment to the smaller shops. This system is in fairly general use on some of the larger roads. These larger shops have the advantage of quantity production on some work. Because of this some of the parts, particularly those made from bar stock, are manufactured in quantities on automatic machines. The smaller shops do not have the advantage of this larger production and, therefore, must turn to the hand turret lathe for producing their repair parts. The hand turret lathe, being an extremely flexible tool, easily and quickly

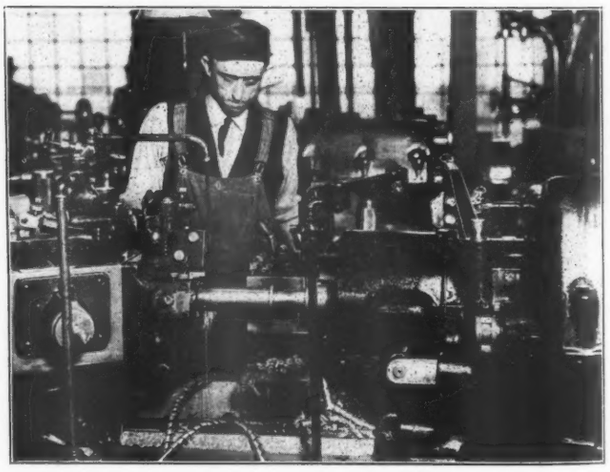


Tool layout for machining a spring bolt on a turret lathe

changed over from job to job, answers the requirements of the average shop. Usually standard turret tools will produce all the work whether the parts are to be finished from bar stock, forgings or castings.

The requirements of a turret lathe

The turret lathe for the average sized shop must be strong enough to use high speed tools to the limit of their endurance and must be powerful enough to push these tools to their utmost. It should have a good range of speeds so that the work can be revolved at the proper



Using two turrets to machine a valve gear crosshead pin

cutting speed. It must also have a good assortment of feeds so that the stock may be quickly roughed off at the roughing speed and feed, and finishing cuts taken at the proper feeds and speeds. These speeds and feeds must be quickly obtained so that the operator can get the full production out of the machine; in other words, run it to its limit.

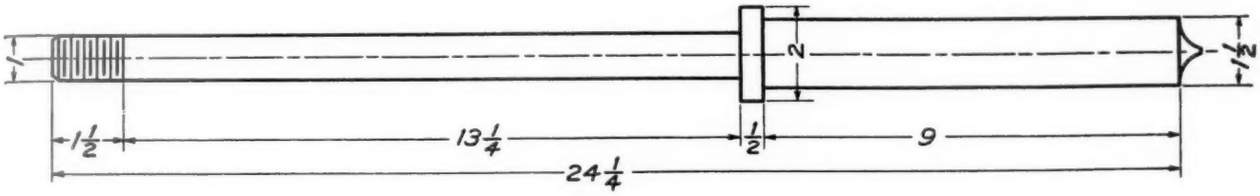
The machine must be so designed and constructed that

all the work produced comes within the required limits of accuracy, for inaccurate work is a dead loss.

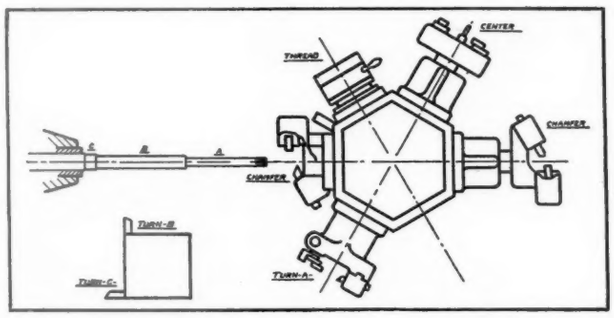
The equipment for the machine varies with the work to be produced; thus, for bar work there is a quick operating automatic chuck to grip the bar and a bar feed for feeding it forward the required length. The turret tools for bar work are adjustable over the practical working range of the machine. For chucking work, the bar chuck is removed from the machine and a three or four jaw chuck is attached to the spindle. The turret tools for bar work are removed from the turret and replaced by standard tools for chucking work.

A great many different parts are best made directly from the bar, but certain other parts are made from forgings which usually have an upset head. The equipment of the present-day turret lathe handles these forgings as easily as it handles the parts made directly from the bar. These forgings are easily held in a two or three jaw chuck, as may be required.

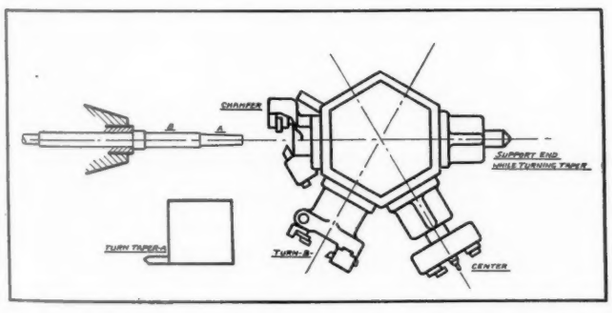
There are two distinct types of turret lathes in general use; one the "ram type" machine, in which the turret is mounted on a slide which, in turn, fits in a saddle which is stationary on the bed, but can be moved from point to point on the bed, as the length of work may require. The turret slide and the turret, slide back and forth in the turret saddle, independent adjustable stops being provided to regulate the length of feed which, of course, depends on the length of the particular part to be finished with each tool. This type of machine is used principally for small parts, such as, water glass fittings, gage lock nuts, gage cock bodies and stems, spanner nuts, relief valve bodies, angle valve bodies and similar small parts which usually are made from brass. Some of the larger shops use ram type machines for studs, bolts, screws, etc., within the capacity of the machine. These machines are of simple construction and are quickly and easily set up and changed over. The tools are practically all standard and can be shifted from face to face of the turret as may be required.



Steel valve yoke guide machined in a turret lathe



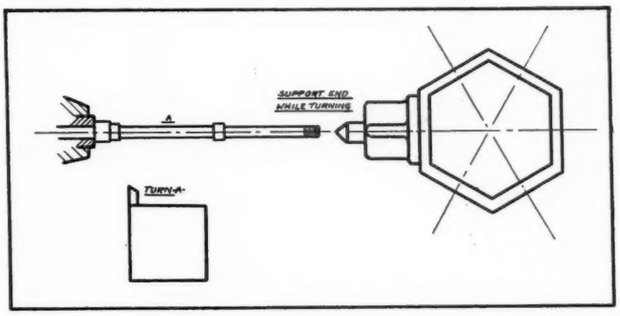
The first chucking position in a turret lathe of a piston valve follower rod



The second chucking position of a piston valve follower rod

A few of the parts machined on a turret lathe

The principal type of turret lathe in use today in railroad shops is known as the sliding saddle type. This machine will, of course, handle all the small parts mentioned above, but inasmuch as the size of the machine makes it slower to handle it is usually used on larger and longer work, such as, bull rings, piston valve followers, cross head pins, link motion pins, rod bushings and similar parts. The double-station turret lathe is particularly effective on these larger parts, for on a vast quantity of the work two operations can be done at the same time. A piston valve follower rod is a good illustration of the combined cuts possible with the double-station machine.



Third chucking position of a piston valve follower rod

The line drawings show how this piece was produced from a forging in three chuckings. It can be seen from the illustrations that the combined cuts possible with the hexagon turret and the square turret very greatly reduce the time and cost of this piece. The production time was 48 minutes each in lots of ten.

Machining a piston valve follower presents an interesting problem. Here is a piece which must be turned, bored and faced in several different places. By combining the turning and boring cuts a remarkable saving in time is effected. This same principle applies to machining a bull ring.

The pieces referred to above are very good illustrations of the advantage of being able to take two cuts at the same time. Another example of this is machining a slide valve guide yoke. The former time for producing this piece was two hours, but this time has now been reduced to twenty minutes, due to the com-

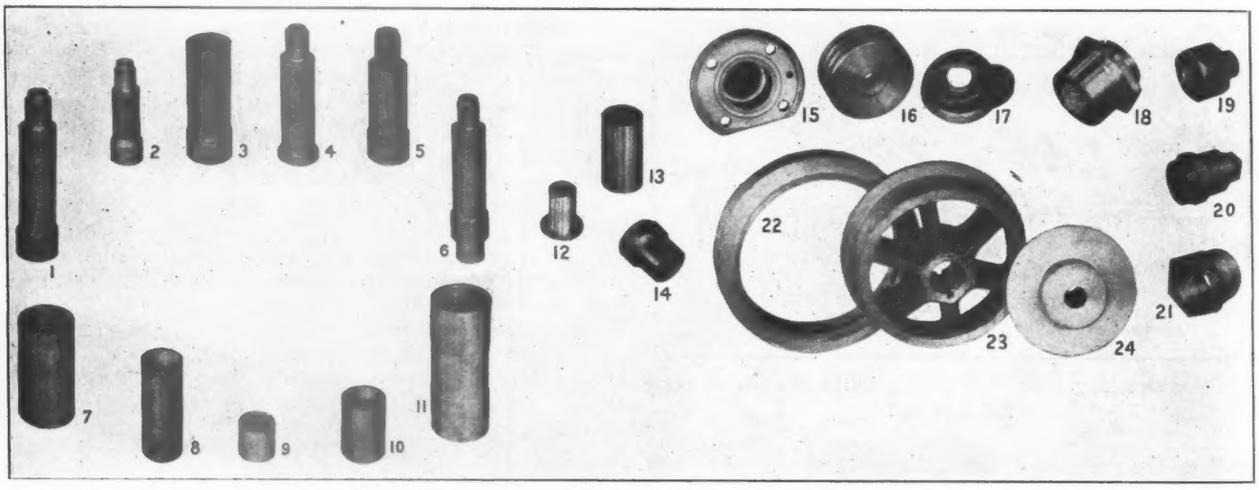
bined cuts taken from both the hexagon turret and the square turret at the same time. This piece is machined in the following manner:

The 2¼ in. diameter 14¾ in. long was reduced to 1 in. diameter in one cut by a universal turner with roller back rests on the turret. At the same time, the square turret carriage is working on the inner end of the piece 1½ in. in diameter by 9 in. long, first necking back of the 2 in. diameter shoulder and then turning this diameter to 1½ in. in one cut. Next, while the universal turner rolls are supporting the outer end of the piece, the 2 in. diameter collar in the center of the piece is turned for a length of ½ in.; then a cutter in the universal carriage squares the shoulders of the collar; next, the pointing tool in the hexagon turret rounds the end of the bar, this being followed by cutting the thread with a die head on the hexagon turret. The piece is then chamfered and cut off with a cutter in the square turret and the machine is ready to make as many additional pieces as may be required.

The third type of turret lathe is the universal brass finishing lathe, commonly known as the "fox lathe." This machine differs from the other two types in several respects. Primarily it is a ram type machine, but between the engine lathe time had been 18 minutes per piece. The machining time on a turret lathe was only six minutes per piece. On the whole job of ten pieces, the engine lathe time amounted to 180 minutes, while the turret lathe time was only 119 minutes, which included the setting-up time.

If a turret lathe is to be used only for bar work, the setting-up time can be greatly reduced by leaving the tools on the turret in what might be called a permanent set-up, which would include three universal roller back rest turners, a pointing tool, an automatic opening die head and a flanged tool holder, to be used for drills and similar tools. Of course, it is necessary, in each case, to change the automatic chuck jaws for the various sizes of stock. In addition, about 15 minutes is required to adjust the back rest rolls and cutters of the universal turners and the complete set of turret tools; another 15 minutes might be required for grinding the cutters and about 15 minutes for setting the stops for tripping the feeds. Once the permanent set-up is mounted on the turret, the additional time required on setting-up the machine is very small indeed, and the savings to be obtained are extremely large.

A valuable feature of the modern turret lathe is the



Typical railroad bar and chucking work

Bar work—1—Fulcrum pin; 2—Eccentric rod pin; 3—Block pin; 4—Radius rod pin; 5—Combination lever pin; 6—Crosshead pin; 7—Hangar bushing; 8—Saddle bushing; 9—Link bushing; 10—Combination lever bushing; 11—Fulcrum bushing—Chucking work; 12—Light armature bushing; 13—Motion pin bushing; 14—Grease cup body; 15—Valve caps for air compressor; 16—Standard stoker piston; 17—Water glass drain bowl; 18—Safety valve bushing; 19—Channel drain cup; 20—Rod grease cup; 21—Grease cup bushing; 22—Bull ring; 23—Follower; 24—Side rod collar.

the turret saddle and the turret slide there is inserted a swivel plate, so that the turret slide may be set at an angle in order to bore or turn tapered parts. A chasing attachment is fitted to this machine so that threads may be chased with a single point tool. A set of leaders and followers is provided to give the necessary pitches for the threads. This machine is used mostly for producing threaded brass parts in extremely small quantities. Inasmuch as the quantities of parts to be produced is constantly growing, this type of lathe is being used less and less, but will probably always be used in some of the smaller shops for their miscellaneous brass work.

The question of set-up time

Formerly, there seemed to be a prejudice against turret lathes in the minds of some railway officers due to what they thought was the extremely long time required in changing over the machine from job to job. In reality, this changeover time is not as great as has been thought. For instance, on a particular whistle stem, fact that on a two-station machine, that is, a machine equipped with a hexagon turret and also a side carriage, two turning cuts can be taken at the same time, or the hexagon turret can be used for turning while the square turret is used for necking, facing shoulders and similar operation.

The turret lathe is coming into more general use in tool rooms for the production of roller flue expanders, rivet sets, reamer blanks and similar work. These parts are produced very much faster than they can be produced on the engine lathe.

Every mechanical officer bases his equipment purchases on their earning power, which is the proper way to purchase machine tools. A comparison of production times on turret lathes with production times of the same work on other machines is very decidedly in favor of the turret lathe, even when the set-up time is charged against the turret lathe output. Remarkable savings are shown on as small as three similar parts, which are usually handled on an engine lathe.

Master Boiler Makers hold eighteenth convention

Reports and papers on scaling, laying out, flanging, welding and cracking included in program

ALL attendance records at conventions previously held by the Master Boiler Makers' Association, May 3 to 6, at the new Hotel Sherman, Chicago, were broken this year with nearly 900 members, ladies, guests and members of the Boiler Makers Supply Men's Association registered at the eighteenth annual convention. Of this number about 375 were members of the Master Boiler Makers' Association.

H. T. Bentley commends work of the association

Following the customary opening exercises, H. T. Bentley, general superintendent of motive power, Chicago & North Western, an honorary member of the association, then addressed the convention. In his remarks he stressed the importance of the committee report on "Causes of Boiler Barrel Sheets Cracking," and stated that it was very desirable wherever possible, not only to locate the cause, but also to suggest a remedy so that everyone would be benefited. The reclaiming and safe ending of boiler tubes and flues is a live subject, and with the pitting and corrosion that is so prevalent in certain sections of the country, he said, it is necessary to reclaim flues where it can be done safely and economically. The amount of money spent on new flues in bad water territories runs into enormous sums, a large amount of which he thought could be saved. Mr. Bentley also commended the railway supply industry for the work it has done in developing useful time and labor saving devices for the boiler shop. Quite often a supply manufacturer will find a crude device which appears to have merit, assist in developing it into a marketable commodity and then sell it.

Following Mr. Bentley's address, the president of the association, John F. Raps, general locomotive inspector, Illinois Central, delivered his annual address. In his remarks he brought out the fact that the duties imposed on the members and those under their supervision have become more intricate since the introduction of the superheater locomotive and the more modern boiler designs. The fabrication of heavy barrel sheets for boilers carrying pressures of from 250 to 400 lb., is extremely difficult, requiring ability, efficiency and decision in the detail of each operation. The remainder of this session was devoted to reports of the secretary and the treasurer and to routine business.

The technical business of the convention began by the presentation of a report entitled "The best and most economical methods of scaling inside of the boiler when the flues and tubes are removed." The final report presented on Tuesday morning was on the question, "What are the causes of boiler barrel sheets cracking at the waste sheet angles and guide brace angles?"

J. A. Doarnberger, master boiler maker, Norfolk & Western, Roanoke, Va., chairman of the Committee for Standards and Recommended Practice—Fusion Welding, reported that the action so far taken by the Master Boiler Makers' Association on the subject of fusion welding, had been referred to the secretary of the Mechanical Division, American Railway Association. The Mechanical Dvision committee, in conjunction with committees from the American Society of Mechanical Engineers and other interested technical societies, is now developing a standard code for welding as applied to the locomotive boiler. It was suggested that the Master Boiler Makers' Association take no further action on fusion welding until the Mechanical Division had arrived at its conclusions. Mr. Doarnberger did not believe that the methods adopted by the Mechanical Division would differ essentially from the practice already outlined by the Master Boiler Makers' Association. It was decided that the committee should be continued and a progress report presented at the next convention.

The final report for the Tuesday afternoon session was made by W. H. Laughridge, general foreman boiler maker, Hocking Valley, Columbus, Ohio, chairman of the Committee for Standard Names for various Parts of the Locomotive Boiler. This committee recommended the adoption of the "Dictionary of locomotive terms" included in the Locomotive Cyclopedia, published by the Simmons-Boardman Publishing Company, New York, as containing the best information of this nature available. The convention accepted a motion to adopt the names given in this dictionary as standard.

Address by J. E. Bjorkholm

The Wednesday morning session was opened with an address by J. E. Bjorkholm, assistant superintendent of motive power, Chicago, Milwaukee & St. Paul, Milwaukee, Wis., who addressed the convention in part as follows: "It is claimed by eminent authority that a 1/16-in. scale on the flues and sheets in a boiler is responsible for a 10 per cent loss in fuel. It only requires some very simple arithmetic to ascertain that on a carrier similar to the property with which I am associated, this would amount to an annual sum of $1,100,000. We have found that by covering the stack and the grates on our locomotives as soon as the firebox inspection and hot work is completed, thus retaining the heat as much as possible in the boiler by preventing circulation of cold air through the firebox and flues, that considerable coal can be saved in firing up the engine. Supposing that you are firing up 1,000 locomotives a day, the saving in fuel accomplished would be only 10 scoops of coal per locomotive, but the saving in fuel for the 24-hour period would be 75 tons of coal and at the end of the year you would have a respectable pile of a little better than 27,000 tons to your credit. Always bear in mind that there are only 133 ordinary scoops full of coal in a ton and I am sure you can very readily find means of saving a lot of coal. The coal bill on a railroad is of such proportions that it offers singular opportunities for economy. I am mentioning this one item because fuel economy and boiler maintenance are closely related."

Following Mr. Bjorkholm the subject of pitting and corrosion was then taken up. The entire session on Wednesday was devoted to this important phase of

boiler maintenance. The discussion consisted mainly of remarks on the subject by prominent railroad water service enginers.

The first paper presented was by C. R. Knowles, superintendent of water service, Illinois Central, which was read by D. A. Steel, associate editor, *Railway Age*. Following Mr. Steel, C. H. Koyl, Chicago, Milwaukee & St. Paul; R. C. Bardwell, Chesapeake & Ohio, and R. E. Coughlan, Chicago & North Western, outlined their views on the subject and on the progress being made to eliminate its disastrous effects. Frank N. Speller, Metallurgical engineer, National Tube Company, also took this occasion to combine the address which he gave Friday morning on the "Corrosion of boiler tubes" with the more general subject of boiler pitting and corrosion.

George L. Hess discusses modern locomotive design and boiler shop work

George L. Hess, superintendent of motive power, Wabash, Decatur, Ill., gave the opening talk at the Thursday morning session. The following are some of his remarks:

"The boiler force should be studying at all times to obtain not only better designs, but the proper application of material. How often we find locomotives with leaky flues, frequently due to the method of application when the locomotive is receiving classified repairs. On one road with which I was connected some years ago, we had a great deal of trouble with flues leaking and the boiler makers did everything that was thought could be done. Finally, a boiler maker had an idea that if we used a different thickness and longer copper ferrule, we would get results. It was tried, and strange to say, it worked. This may not be applicable to all roads, but it was to that certain road, where water conditions were such that it was difficult to maintain tight boilers.

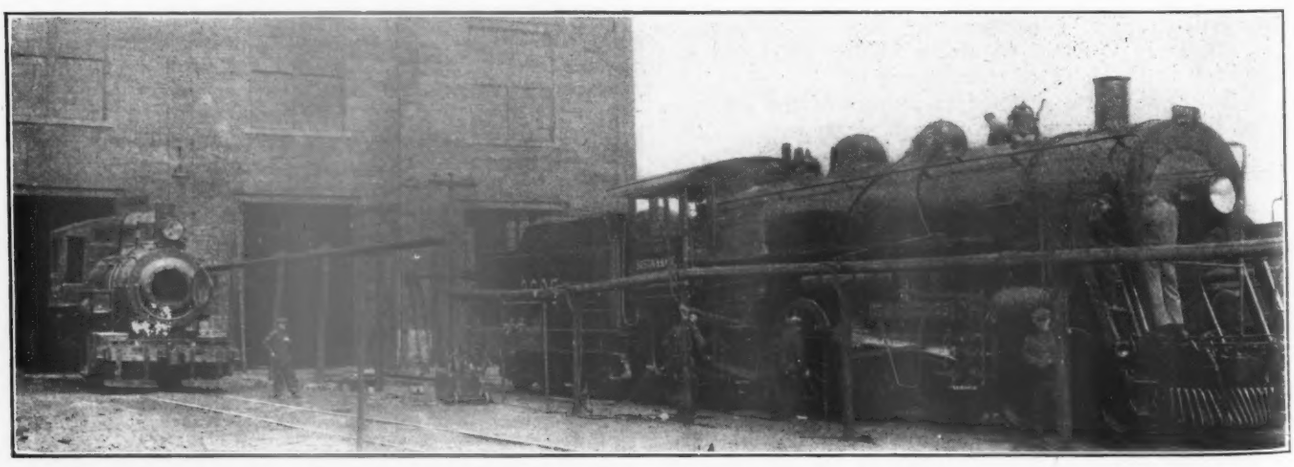
"The boiler forces should at all times study water treatment. We realize the average boiler maker could hardly be expected to be a chemist or a water engineer, but at the same time he could give the matter considerable study, and there is no reason why every man should not know something about water treating. Its importance is so great and is such a relief to the railroad that the more study and the more water treating that can be given, the better the results for all concerned. On one of the important railroads in the United States, having 700 locomotives, and where water is treated at practically every tank, there is an enginehouse where it dispatches an average of 90 locomotives per day. During the year 1926, 100 broken staybolts were renewed in this enginehouse. The average number of broken staybolts replaced on all locomotives on the road were five per locomotive per year. On this same road, it used to be necessary to apply from seven to nine fireboxes per month, but after treating water, this number has decreased, and in the past nine years there has been an average of less than 18 fireboxes applied per year. A flue failure on the road is almost unknown, and calking flues in the enginehouse is almost a lost art."

The report on the "Most efficient methods of reclaiming and safe ending boiler tubes and flues" was then taken up. Abstracts of this report as well as a number of others presented at the convention will be published in a future issue of the *Railway Mechanical Engineer*. The final paper of the convention was on the subject of corrosion of boiler tubes which was presented by Frank L. Speller, metallurgical engineer, National Tube Company, Pittsburgh, Pa.

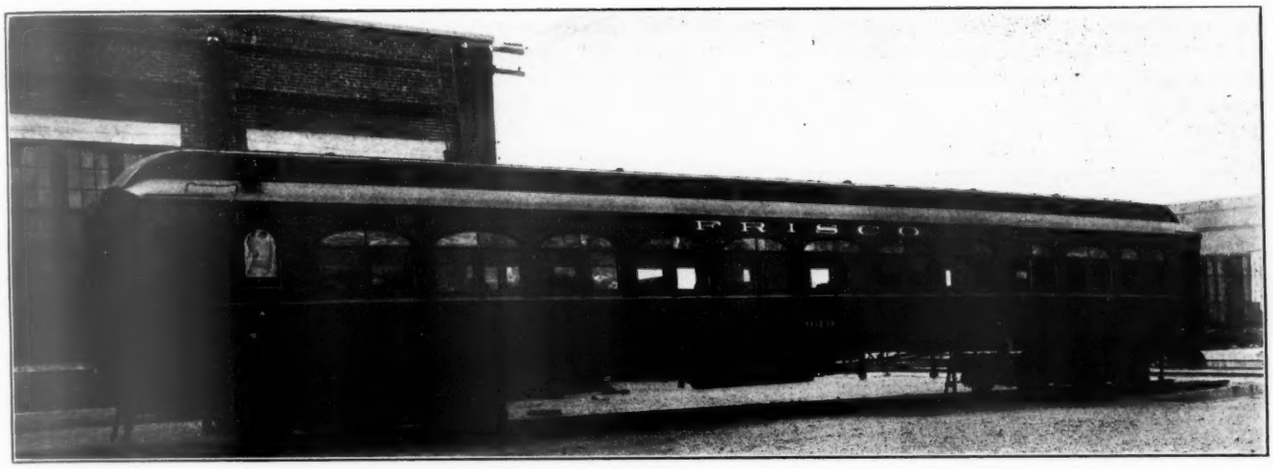
Election of officers

The final session was devoted to the transaction of routine business. The following officers were elected for the coming year:

President, W. J. Murphy, division boiler foreman, Pennsylvania; first vice-president, L. M. Stewart, general boiler inspector, Atlantic Coast Line; second vice-president, George B. Usherwood, supervisor of boilers, New York Central; third vice-president, Kearn E. Fogerty, general boiler inspector, Chicago, Burlington & Quincy; fourth vice-president, Franklin T. Litz, general boiler foreman, Chicago, Milwaukee & St. Paul; fifth vice-president, Henry J. Raps, general boiler foreman, Illinois Central; secretary, Harry D. Vought; treasurer, W. H. Laughbridge, general foreman boiler maker, Hocking Valley; executive board (one year): Charles J. Longacre, foreman boiler maker, Pennsylvania; R. W. Clark, general foreman boiler maker, Nashville, Chattanooga & St. Louis; O. H. Kurlfinke, boiler engineer, Southern Pacific; executive board (two years): George G. Fisher, foreman boiler maker, Belt Railway of Chicago; John Harthill, general foreman boiler maker, New York Central; Ira J. Pool, district boiler inspector, Baltimore & Ohio; executive board (three years): Albert F. Stiglemeir, general boiler shop foreman, New York Central; C. H. Browning, general foreman boiler maker, Grand Trunk; and George L. Young, foreman boiler maker, Reading. Albert F. Stiglemeir was elected chairman of the executive board and Ira J. Pool secretary.



Putting the finishing touches on a large Pacific type locomotive just out of the Billerica shops of the Boston & Maine



Frisco passenger car just out of the shop after being finished with Duco

Frisco gets good results with lacquer

Economy of Duco applications shown by 2½ years service on both passenger cars and locomotives

By H. L. Worman

Superintendent of motive power, St. Louis-San Francisco, Springfield, Mo.

SINCE November, 1924, the St. Louis-San Francisco has applied the lacquer finish known as Duco to 274 passenger cars of both steel and wood construction, to 626 locomotives in all classes of service and, within the past six months, to 30 passenger car interiors.

Cab with a protective coating on the windows ready for the application of lacquer—Curtain temporarily in place

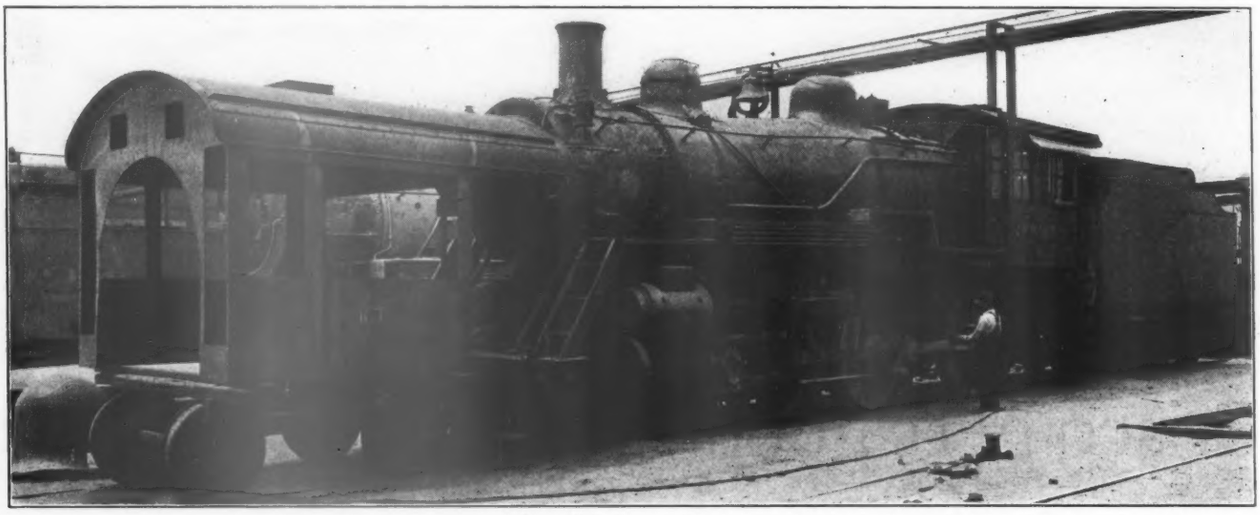
The results on steel equipment have been satisfactory, demonstrating marked advantages over former finishes in speed of application, durability under adverse climatic conditions, attractive appearance which improves after repeated cleaning, and other operating advantages. While wooden cars have always presented a more difficult problem of painting than steel cars, from the standpoint of the durability of the finish, and some early experiences with lacquer on wooden cars of the St. Louis-San Francisco were unsatisfactory, a flexible lacquer, designed especially for wooden interiors and exteriors, has now been in service for about a year with good results.

The quick-drying feature of lacquer, together with its rapid application usually by means of a spray gun, greatly reduces the time which equipment must spend in the paint shop, and experience on the Frisco has shown that this time, as compared with that necessary with the common varnish system, is approximately 50 per cent less. The saving in time is offset to a certain extent by greater material cost, but this leaves a large net economy due to greater durability of the lacquer finish, easier cleaning and other factors. While varnished Frisco cars formerly had to be refinished on an average of every 18 months, 274 of these cars, sprayed with Duco, in most cases over the old undercoats, have now been in service up to 30 months with no attention except cleaning and they show no indication that refinishing will be necessary until after a still further extended period of service.

Locomotives finished with varnish are in service an average of 12 to 18 months before the finish needs renewal, but the average service life with Duco finish on a locomotive is increased to 18 to 24 months and the labor cost of application is 30 per cent less. It is easier to clean cars or locomotives finished in lacquer due to the hardness and toughness of the film, but an accurate estimate of the actual saving would be difficult to make.

A brief description of the lacquer used on Frisco equipment may be of interest. Manufactured by E. I. du Pont de Nemours Company, Inc., Parlin, N. J., it consists in general of nitrocotton with a small percentage of other ingredients dissolved in special solvents, and a finely ground pigment to provide the color. It is in effect a finishing material used in place of color and varnish coats. When applied to a surface the solvents

quickly evaporate, leaving a film which is tough and hard. While a paint or varnish film dries by oxidation, lacquer dries by evaporation and as soon as this action ceases a chemically inert and stable thin film of material has been deposited on the surface which does not check



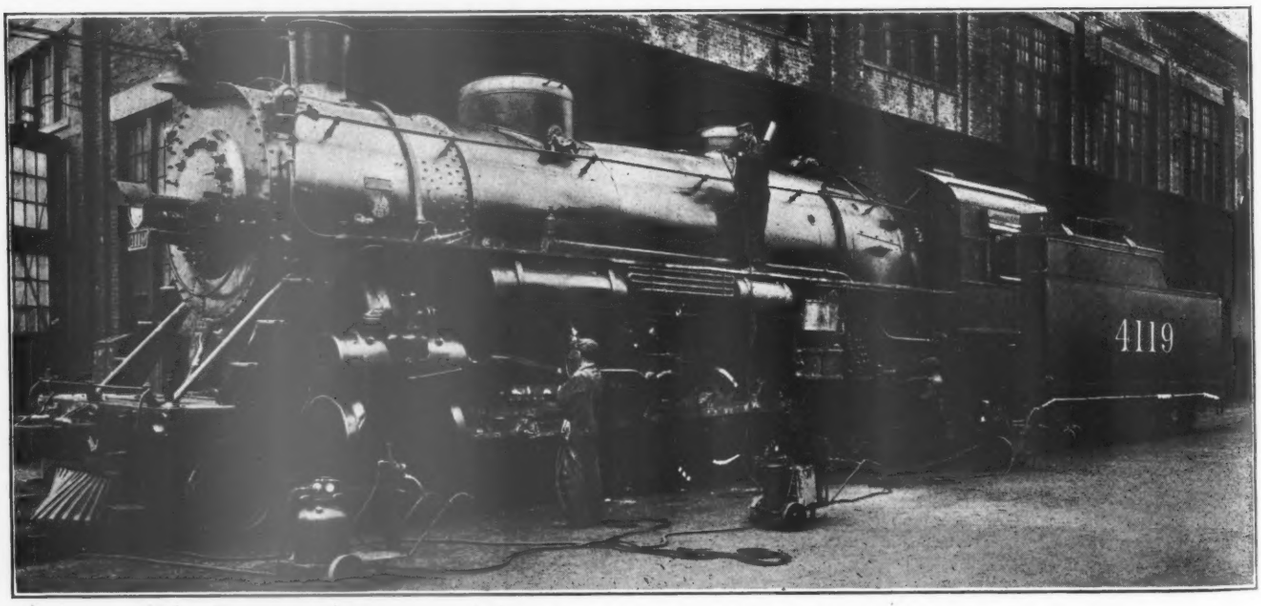
Spraying undercoat on sand-blasted locomotive

or braise and which wear subsequently by slow erosion only.

Paint shop operations speeded up

One of the most important advantages secured by the use of lacquer on Frisco equipment is greater speed of application. Undercoats are applied in practically the same time by both systems, but the greater speed of the application of lacquer is such that the total time is only seven days for the complete refinishing of a passenger coach exterior from the surface out, as compared with 14 days or more with the previous finish. This enables the same amount of work to be done in the paint shop with only 50 to 70 per cent of the previous force. An example of how the work can be speeded up in an emergency was afforded recently when urgent need for two passenger cars in the Frisco paint shop at Springfield, Mo., unexpectedly developed because of a wreck on the road. These cars were primed and surfaced ready for application of the finish coats, were sprayed with two coats of Duco, lettered and delivered to the transportation department in eight hours.

The increased speed of application has materially reduced the demand for paint shop space. Another advantage, due to the rapid drying feature of lacquer, is that finishing work may be safely done on cars in the paint shop with only reasonable precautions against the circulation of dust in the air. Another feature of great importance is that variations in temperature and humidity cause practically no difference in the rate of setting of a lacquer film while under certain atmospheric conditions paint shop work was greatly retarded due to slow setting of the former finish.

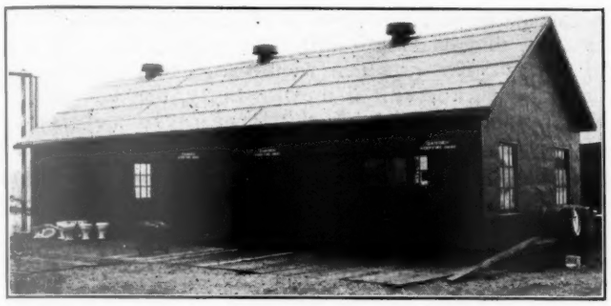


Application of Duco to Frisco locomotive at West Springfield, Mo., shops

A large percentage of Frisco cars are refinished by the application of Duco over old undercoats. In such

cases, the time required for refinishing is three to four days as compared with six or seven days by the former system. Patching of mechanically injured cars is made comparatively easy owing primarily to the fact that there is no oxidization or chemical change in lacquer, once hardened, and when a second coat is applied it unites with the first to make a single coat.

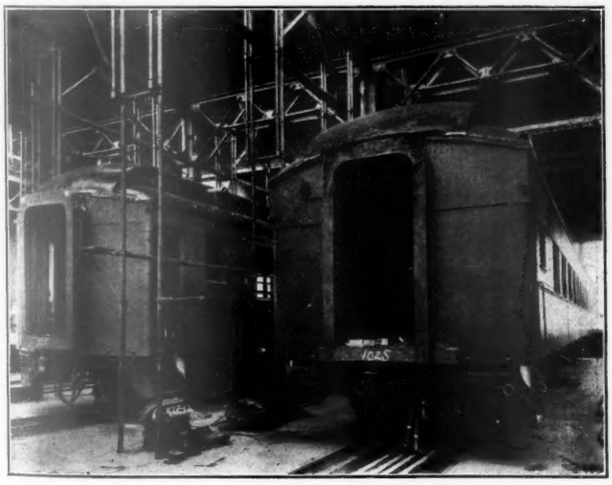
The interiors of 30 passenger cars are finished largely



Up-to-date facilities are provided for the safe storage of inflammable painting materials of all kinds

by spraying with lacquer, which saves the labor of rubbing down with pumice stone, formerly necessary to reduce the gloss of varnish finish. Owing to the time saved in spraying and the elimination of rubbing down the interior, a standard passenger car can be refinished with Duco on the inside in six days as compared with nine days with varnish. A combination of the spray and brush methods of application has given the best results on car interiors, large areas being sprayed and small areas and the junction between colors brushed. Trimmings can be applied to sash, doors and car interiors two hours after the application of the lacquer.

In addition to the equipment mentioned above, four Frisco 100,000-lb. steel hopper cars and one caboose car have been finished with lacquer. The caboose has been in service a year, the finish showing no signs of deterio-



Paint shop view—Light-weight, easily adjustable scaffolds facilitate painting operations

ration. Lacquer is also used on Frisco car furniture, window curtains, imitation leather, linoleum aisle strips, steel hoppers, etc. Sash and doors are mounted on the racks shown in one of the illustrations, the glass covered around the edges with a protective coating of soap and whiting, and lacquer sprayed on, with a substantial saving in time over former brush methods. A similar method is used in protecting the windows of locomotive cabs while being sprayed. The coating is readily removed from the glass with a knife after the application of the lacquer.

The methods followed by the Frisco in applying undercoats and finish lacquer coats follow specifications suggested by the manufacturer.

Use of lacquer on locomotives

On November 29, 1924, the first Frisco locomotive, No. 1294, was sprayed with lacquer and since that date 626 locomotives have been finished with this material. Experience has shown that compared with a life of former materials of 12 to 18 months, lacquer gives 18 to 24 months' average service. The cost of application is

Rack for spraying sash and doors—Glass protected by easily-removed coating of soap and whiting

30 per cent less and the cost of the material about 30 per cent more, leaving a substantial net saving due to the greater durability of the lacquer finish and more rapid preparation of the locomotive for service. As in the case of cars, this latter feature is due to the fact that lacquer dries quickly and does not interfere with completion of the many small jobs which must be handled promptly in preparing a locomotive for service.

All parts of the locomotive and tender are finished with lacquer except the smoke box, firebox, side sheets and engine and tender trucks. The usual practice as shown in one of the illustrations is to use one painter with a spray gun on the running boards for finishing the upper parts of the locomotive and to have two on the ground to spray cylinder jackets, motion work, etc. Asbestos

particles and dirt of all kinds are first blown off by compressed air and the lacquer is sprayed on with the usual spray guns. The tender is ordinarily finished and lettered in the tank shop and the cab in the cab shop, but all of the rest of the locomotive is sprayed during the noon hour. Mechanics can go to work on the locomotive almost immediately afterwards to perform any necessary finishing operations and in this way the painting causes no delay in getting the locomotives ready for service.

Economy in cleaning—precautions

The use of lacquer has produced another marked advantage in connection with the cleaning of car equipment because the surface is hard and smooth and does not hold dirt and foreign material as readily as the varnished surface. As a result, cleaning costs are substantially reduced. Plain soap and water has been found to give best results in cleaning. Especially on interiors is the cleaning advantage noticeable and in this case soap and water or oxalic acid or other cleaning materials on varnished interiors produce a streaked effect and ruin the finish. Lacquer is not harmed and, in fact, improves in appearance.

In the period of 2½ years in which lacquer has been used, extensively on the St. Louis-San Francisco there have been no indications of harmful results in health hazard, or fire risks.

Editor's Note.—The specifications to which Mr. Worman refers cover in detail all operations in the finishing of the cars from the bare steel or wood. For steel car exteriors, the first four operations, which require five days for completion, include the application of a coat of special steel primer, a coat of special surfacer, the puttying of major imperfections, and a knifing coat. The time required for the surface to dry at a temperature of 70 deg. F. after these operations varies from over-night to a maximum of 48 hours, the maximum time applying to the primer coat and the minimum to the putty. The primer and surfacer may be applied either by brush or by spray. The specifications then call for wet sanding and a light dry sanding followed by the application of a special surfacer sprayed on and allowed to dry for one hour. On the seventh day, after again lightly sanding, the first coat of lacquer is sprayed on. After this coat has dried for 1½ to 2 hours, the second lacquer coat is sprayed on and allowed to dry over-night. The eighth and ninth days are given over to lettering and striping. Where gold leaf is used, this is protected with two pencil brush coats 24 hours apart. Where brush lacquer is used, its application completes the job. The specifications call for two-thirds gallon of unthinned lacquer per 100 sq. ft. of surface for two coats, reduced in the proportions of three parts lacquer and one part thinner, with some variation depending upon weather and local conditions. The procedure for wooden cars is the same except that a wood primer and a flexible lacquer are used.

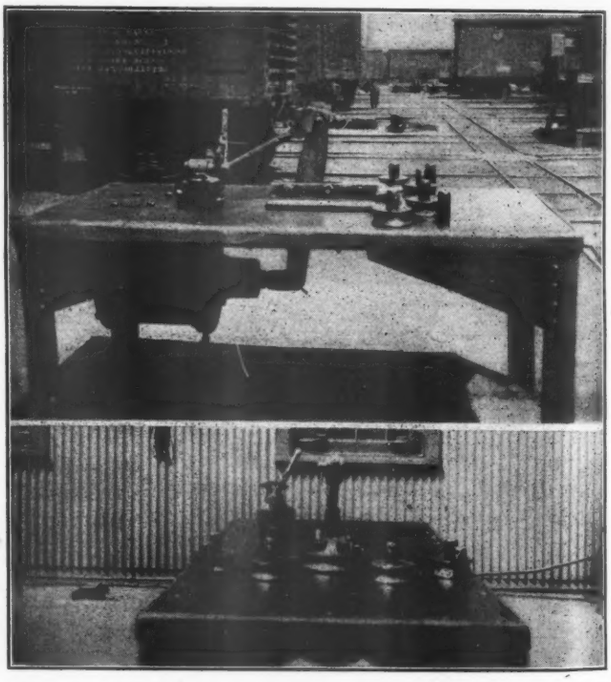
For car interiors, the bare surface is prepared by the application of a coat of special interior primer, putty and a glazing coat. These operations require two days followed by a third day for sanding and a fourth for the application of a neutral ground coat. On the fifth day, after a light dry sanding, the surface is finished with one coat of lacquer.

The specifications for finishing locomotives and tenders cover a maximum of eight operations finished on the fifth day. For the jacket, drivers, steam chests and underframe, which are not usually surfaced, three operations, consisting of the application of a steel primer followed by two coats of lacquer, are finished in two days, the primer coat requiring 24 hours to dry. On domes, cabs and tanks which are usually surfaced, the operations are much the same as those for the exterior of steel cars except that the putty is applied to the primer coat without the application of the surfacer. The eight operations, including striping and lettering, on these parts are completed on the fifth day. The car is then ready for service.

The specifications for the repair of injured Duco finished surfaces first call for the cleaning of the surface with sandpaper, or sand blast if the area is large enough, and gasoline. After the application of a coat of special primer, which requires ½ hour to dry, the damaged part is knifed in with putty, dried two hours and sanded smooth. A thin coat of lacquer is then sprayed over the injured area, or a brush lacquer may be used, and after drying, the entire panel containing the injured area receives an extra coat, shielding the surrounding panels.—Editor.

Bending machine for small size pipe

THE accompanying illustration shows a pipe bending machine which is used at the Secaucus, N. J., car repair tracks of the Delaware, Lackawanna & Western. The table, which is 3 ft. wide and 6 ft. long, is supported on four angle iron legs which are 2 ft. 8 in. high. The table consists of a top and bottom iron plate ¼ in. thick between which is a layer of wood



Side and end view of a substantially made pipe bending machine

2½ in. thick. Fourteen 1½-in. holes are drilled in the table, seven on each side of the shoe. Car body pins fit into these holes. The power is furnished by means of a 14-in. brake cylinder which is connected up to and operated by a three-way valve. Any size pipe up to and including 2 in. can be readily bent on this machine.

Some comments on shop tools

Use of modern shop machinery one of the principal factors in reducing repair costs

By C. A. Shaffer
General supervisor of shop machinery and tools, Illinois Central, Chicago

IN order to have good locomotives and cars with which to serve the public properly, railroads must spend a considerable portion of their earnings in keeping the rolling stock and work equipment in first-class operating condition, and one of the principal factors in solving the problem is the use of modern shop machinery. That there is a growing appreciation of this fact is evidenced by many of the railroads purchasing and installing within the last few years a large amount of new and up-to-date shop equipment to replace obsolete machines. In order to keep pace in repair shops with advances in locomotive and car design and capacity, an ever-increasing amount of machine tools is required. Specialized and costly labor provides an additional incentive for installing the best modern equipment.

The up-to-date tool room and tool service department at the new Illinois Central shops, Markham, Ill.

While conditions and consequent practices in most railroad shops differ considerably from those in industrial manufacturing plants where mass production is the rule, there are many modern and highly improved machines now offered for railroad work. These cannot properly be classed as special or single purpose tools, yet some may have been designed primarily for a specific job and later improved or found to be suitable and satisfactory for additional operations.

Starting with the heavier class of machine work, one may now find locomotive cylinders being completely machined, with the exception of drilling and tapping for studs, on one machine and with little change in setting. On this job, one machine does the work formerly required of two, and the machine is less in first cost. The time required to machine the cylinders complete is also in favor of the single modern machine, this being mostly due to the saving in time realized by not having to change such a heavy job between planer and boring mill and make two separate set-ups. Then, too, the modern machine on account of the boring, planing and milling features may be profitably utilized on a variety of other miscellaneous heavy odd jobs when not used on cylinder work. The average time of machining the largest locomotive cylinders complete except drilling is 35 hr. as compared with 50 to 60 hr. when separate machines are used.

Machinery for driving wheel work has been improved so that the good-sized shop can ill afford to be without it to take care of the different operations presented in connection with maintaining wheels, axles, crank pins and tires. It is generally conceded that where much tire turning is to be done, a heavy duty lathe unencumbered with special attachments is best. For truing axle journals, crank pins and boring for the latter, the modern combination axle journal, crank pin turning and wheel quartering machines replace the older equipment and methods and save several handling and set-ups of the work.

The majority of locomotive main rods and side rods used today are more difficult to machine than those of 10 or 12 years ago, on account of the changes in material used and the requisite heat treatment. As a result it is found that machines and cutters which performed satisfactorily on old rods are not adequate to cope successfully with present-day conditions. By replacing some of these old machines and tools with new heavy duty equipment, the size of cuts, speeds and feeds are increased to the extent that work is turned out in almost one-half of the time required by the old tools

and without the worry and delay of breakdowns incident to old machines.

The development of milling machines and cutters for all classes of work is remarkable, and within the last few years special attention has been given by some manufacturers to improvements making this equipment better adapted for railroad work. Extra heads and spindles with automatic control have been applied to heavy horizontal (planer type) machines for the rapid production of driving boxes, crossheads or shoes and wedges. By this method with modern machines, average production records have been obtained on driving boxes of 15 min. each, which includes set-up time, and for the larger class of shoes and wedges an average of 11 min. per piece, the latter being milled in a two-row quick set-up fixture of five shoes or wedges in each row.

Heavy vertical spindle milling machines with compound and rotary tables for machining locomotive rod ends, rod straps, etc., have also justified their use on this class of work.

Horizontal knee-type millers, more in the general purpose machine class, are increasing in popularity and

facing and some new work on guide bars. By this method a highly satisfactory job is obtained in about 50 min. as against 1½ hr. to 4 hr. on the planer. When not finishing guides, surface grinders are used on such locomotive parts as truck equalizer bearings, rocker boxes, exhaust bases, eccentric straps, steam pipes, driving box cellars, etc. Where only a plain surfacing operation is required, a saving of about 60 per cent in time over other methods is secured.

Comments on general machine tools

The great improvement in standard machine tools such as lathes, planers, boring mills, shapers and drills, makes it advisable to give careful consideration to these tools in any program of machine shop improvement. These machines have been designed to meet modern production requirements using the best of high-speed steel cutting tools. Operating handles and levers are located to save time and every effort is made to cut out waste time and effort. Older machines of light weight and improper design have no place in the modern shop where large output is required.

The effect of modern tools on the morale of workmen

Heavy machinery bay in the new Illinois Central shop at Markham, Ill.

numbers for medium and light work, such as eccentric cranks and rods, radius rods and hangers, combination levers and links, piston rods, valve bushings, etc., by reason of the time which may be saved where there is any considerable amount of such work to be done. Attention is called to the absolute necessity of proper holding fixtures on these machines in order to obtain the best results. In this respect, several manufacturers have made commendable efforts to furnish superior fixtures and tooling equipment for their machines, thus promoting greater production.

Probably the greatest improvement and change in method of doing certain work in railroad machine shops has been brought about in the last few years by new and improved grinding machines for both face grinding and circular (internal and external). It has been the experience in shops throughout the country that certain jobs, formerly done by cutting tools in planers, boring machines, lathes or drill presses, are now handled better and in less time by grinding, and a substantial saving is effected by the installation of modern machines of this kind.

Large face grinders are put in primarily for re-sur-

is also desirable in that the men take pride in their machines and almost without exception turn out a larger amount of better quality work.

Improvements in shop equipment, or savings to be effected by this equipment, are not confined to the large machine installations. Substantial savings result from the use of many portable tools and devices which have been thoroughly tested and found to save time and money in accomplishing work formerly done by crude and laborious methods. Some of these portable devices may be mentioned as follows: Boring and facing machines, crank pin truing machines, journal truing machines, autogenous welding (and gas-cutting) equipment and various improved testing devices and instruments.

Many of the larger railroads have machine tool committees whose duties require them to pass upon proposed equipment for their various shops, but the burden of initial recommendation usually falls upon the shop superintendent, master mechanic or general foreman to cover tools for use under his jurisdiction. It seems entirely proper that the man in charge of the shop should be the one to say what is needed to produce the work at the lowest cost, but in order to do this he must

be well informed regarding the best machines and conditions governing their application to his work.

With the average shop foreman's experience and a reasonable knowledge of modern machinery on the market, it should not be a difficult matter to work out a sensible list of recommendations in this line when called for by the management. The foreman who is alert in this matter will be constantly in touch with machine shop conditions and costs to produce the work. Assuming that such is the case, it would only require a short time to make up the list, based upon the data gathered from records kept during the year.

The items on which the greatest savings can be made receive the most favorable consideration by the management when authorizing expenditures, and it behooves every shop foreman to be alive to the situation in his department. He can take cost cards, or if such cards or records are not kept, a daily memo of what is the best output of certain machines and use this as evidence on which to base recommendations. Assuming that new machines are to be asked for to replace existing equipment, and the time required or cost of producing with the old machine has been calculated, a comparison may be made with time studies of the same kind of work done on modern machines and with production guarantees of the machine manufacturers to determine what time saving can be made. The result is then figured against the purchase price and installation cost of the new machine in order to estimate returns to be realized on the investment.

For example, figures shown in the table illustrate a method of estimating the savings possible by the installation of a modern 90-in. driving wheel lathe, which is a single-purpose machine and one of the most expensive of railroad shop tools. In the case in question, the new machine is to replace a wheel lathe about seven years old and in fair condition considering the service performed, but with maximum feed of ¼ in. to 5/16 in., depth of cut ⅜ in. to 7/16 in., and equal limitations for finishing cuts requiring on an average four hours floor to floor to turn a pair of driving wheel tires. At that rate of production the shop requirements for driving wheels are not met and the advisability of installing a modern 90-in. wheel lathe comes up for consideration. An analysis of the cost of installing the new lathe is shown in the table, including seven major items as indicated and totaling $30,300.

With this new machine, the tires on a pair of driving wheels can be turned in one hour using a roughing cut of ½ in. to ⅝ in. deep with ⅜ in. feed, and finishing with broad-face forming tools in two or three revolutions. Comparing this with the production of the old machine, there is a saving of three hours time on each pair of wheels, and with a basic average of only 2½ pairs per day to be turned, would total 2,250 hr. per year for one machinist to 75 cents an hour and one helper at 52 cents an hour, amount to $2,857.50, or about 10 per cent of the money invested. The real saving is materially greater because in this calculation account has not been taken of out-of-service time of the old machine due to repairs necessitated by breakdowns.

Servicing work necessary

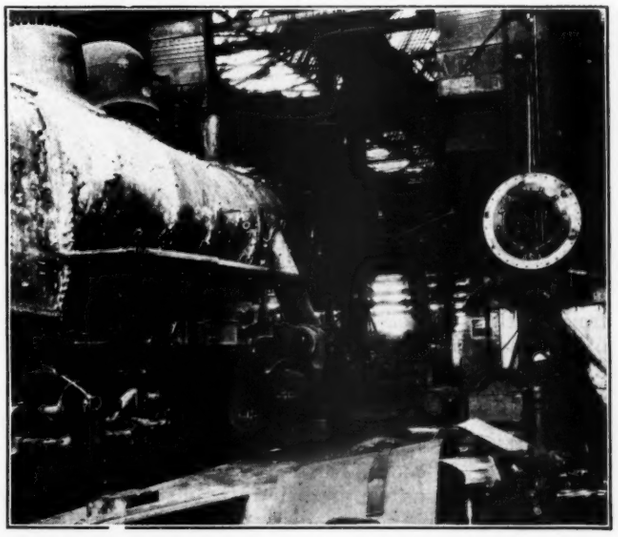
For example, particularly if pressure is brought to bear to obtain greater output from the old machines, general weaknesses develop such as when feed screws and nuts strip the threads, or other small parts around the tool posts give away. Such breakdowns cause delay to locomotives passing through the shops, the total cost of which it is difficult to estimate.

One of the ways in which manufacturers can help the railroads and incidentally themselves is by furnishing increased service for new shop machinery from the time it is first installed until the shop forces become thoroughly familiar with its operation and possibilities in the way of production. There has been a noticeable tendency for the more progressive manufacturers to furnish increased service of this kind in recent years, but in some cases still more of this servicing work would be helpful. Special and extra large machines need close attention on the part of both manufacturer and railroad forces until thoroughly broken in and affording the desired results in the way of production. Many instances have been known where new machines *never* develop their full value from a production standpoint due to unfamiliarity of the operator with the machine and its possibilities. In fact, this lack of knowledge often leads to actual damage which is expensive and creates controversy regarding the responsibility. In such cases, the railroad loses the production possible with new machines and the manufacturers suffer a loss in prestige because the relatively poor performance of the machines soon becomes a matter of common knowledge.

Representatives assigned to carry on this servicing work should be entirely familiar with the construction and operation of their respective machines which is not always the case at present. It is important that certain machines be supervised during installation, broken in and demonstrated to the satisfaction of shop forces by competent service men, and subsequent periodical visits will be well-worth while. It is realized that this servicing work is expensive and in the end must be paid for by the railroad, but from the point of view of returns, it is a paying investment.

Complete installation cost of 90-in. driving wheel lathe

Cost of new machine (including complete electrical equipment)		$25,000
Removal of old machine (35 tons at $20 per ton)		700
Excavation and foundations (50 cu. yd. at $16 per yard)		800
Unloading and placement (60 tons at $40 a ton)		2,400
Wiring (60 hp. at $15 per hp.)		900
Storehouse expense:		
½ per cent of machine cost	$125	
7 per cent of material	55	
		180
Freight at .006 per ton-mile		320
Total		$30,300
Scrap value of old wheel lathe		1,500
Net cost of installing new wheel lathe		$28,800



Smoke box fronts are hung on a column where they are out of the way while the locomotive is undergoing repairs at the system shops of the Lehigh Valley, Sayre, Pa.

Fuel Association has heavy program

Locomotive devices and Diesel engines among subjects of committee reports

THE International Railway Fuel Association, which is growing each year in numbers and in influence on railroad operating efficiency, particularly with respect to the purchase, storage and use of railway fuel, held its annual convention at the Hotel Sherman, Chicago, May 10 to 13, inclusive. At this, the nineteenth meeting of the association, President E. E. Chapman, engineer of tests of the Atchison, Topeka & Santa Fe, presided, and the opening session was addressed by three nationally-known speakers including Carl R. Gray, president of the Union Pacific System; George Otis Smith, director of the United States Geological Survey, and Dr. H. Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers.

During the course of the convention other addresses were made by T. H. Williams, assistant general manager, Southern Pacific; N. B. Ballantine, assistant to the president of the Seaboard Air Line; L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul; E. E. Regan, general superintendent of the New York, New Haven & Hartford; H. S. Rauch, division superintendent of motive power, New York Central; C. F. Richardson, director of the National Coal Association; A. E. Warren, general manager, Canadian National; C. B. Page, manager, Steammotors Company, and F. S. Wilcoxen, president, International Railway Supplymen's Association. Thirteen committee reports were also read and discussed by those attending the convention.

The grand ballroom of the Hotel Sherman was taxed to capacity at the initial session. In opening the convention, President Chapman called attention to the fact that the International Railway Fuel Association comprises within its membership representatives from nearly all ranks and departments of the steam railroads and emphasized the desirability of this feature since the conservation of fuel depends upon the whole railway organization rather than upon any individual group of men. The fuel which can be used with least over-all cost, taking into consideration length of haul, with the least loss of time in turning locomotives at terminals, should be secured, every item bearing on the ultimate cost of fuel to the railways, being carefully analyzed before contracts are let. Mr. Chapman briefly reviewed the various important factors in the economical use of locomotive fuel and also pointed out that fuel, burned in other than locomotive service and representing from 10 to 14 per cent of the total fuel bill, presents probably the greatest problem which faces a fuel conservation program inasmuch as this fuel is used in so many small units difficult to supervise thoroughly.

The new officers

The officers who were elected to serve during 1927-28 are as follows: president, J. E. Davenport, division superintendent N. Y. C.; vice-presidents: C. H. Dyson, assistant fuel agent, B. & O.; T. C. Hudson, assistant general superintendent motive power, Can. Nat., and W. J. Tapp, fuel supervisor, D. & R. G. W. Elections to the executive committee were as follows: W. G. Black, mechanical assistant to the president, Erie; J. D. Clark, fuel supervisor, C. & O.; H. Morris, superintendent fuel and locomotive performance, C. R. R. of N. J.; J. M. Nicholson, fuel conservation engineer, A. T. & S. F.; C. T. Winkless, fuel agent, C. R. I. & P.

The 1928 convention will be held at Chicago during May, the exact date to be announced later.

Economies in long locomotive runs

By T. H. Williams

Assistant general manager, Southern Pacific, Los Angeles, Cal.

In January, 1924, the Southern Pacific was operating six trains a day between Los Angeles, Cal., and El Paso, Tex., and two between Los Angeles and Tucson, Ariz.; that is, four trains per day in each direction.

Prior to the time we started to run our engines through, it required 40 locomotives to handle the eight trains, which included sufficient power to handle the pool of runs and to take care of relief work and the shopping of the engines.

These 40 locomotives consisted of Mikado, Pacific, ten wheeler and Atlantic types, being assigned as follows: Between Los Angeles, Cal., and Yuma, Ariz., a distance of 252 miles, we used the Mikado type. On two of these trains we used the Mikado engine between Los Angeles and Indio, a distance of 130 miles, and at Indio these engines were relieved by Pacific type power, the latter engines making the run from Indio to Yuma, a distance of 122 miles. At Yuma the ten-wheel engines were used for the run to Tucson, Ariz., a distance of 251 miles. At Tucson Mikado engines were placed on the trains for the run from Tucson to Lordsburg, a distance of 164 miles. At Lordsburg Pacific and Atlantic type engines were placed on the trains for the run to El Paso, Texas, a distance of 148 miles.

Trains were handled in this way prior to the time we started to run locomotives through between Los Angeles and El Paso, providing for five sets of locomotives and making four changes at intermediate terminals in the 815-mile run.

In January, 1924, we placed in service 10 Mountain type engines to run through and discounted cutting engines in and out of trains at all of these district and division terminals. Later, as more of the mountain type engines were received, we filled the pool with a complete complement of this class of power.

Today we are running 10 passenger trains per day, five in each direction between Los Angeles and El Paso, and have 25 mountain type engines assigned to the through service. This is sufficient to take care of relief work and to provide for shopping.

For a long time we ran these engines without the protection of having an engine of this type at intermediate terminals to protect in case of engine failure, but recently we established the practice of changing one engine out at Tucson, Ariz., and one at Yuma, Arizona, on one westbound passenger train each day; this to give us an engine at these two points for protection in case of engine failure and to equalize the mileage made by the total engines employed in the pool.

To handle the 10 trains per day under the old method of operation of changing engines at district and division terminals, it would require 50 locomotives, while under our plan of running the engine through it requires 25 locomotives.

Since January, 1924, the date we started to run the engine through, we have constructed a new main line in Arizona from Wellton to Picacho, via Phoenix, which has added 44 miles to the run to El Paso and gives us a double track line between Wellton and Picacho.

We have also acquired the El Paso & Southwestern Railroad running from Tucson to El Paso, giving us a double track line between these two points and increasing our mileage via this route 29 miles in the total distance between El Paso and Los Angeles.

By the construction of the new line through Phoenix, the acquisition of the El Paso & Southwestern, and the scheduling of our trains over these new routes, we have increased the run of the Mountain type engines from 815 miles to 843 miles, 858 miles and 888 miles.

These engines after the run of 888 miles have an average layover at El Paso of 14½ hours and at Los Angeles, 26 hours. At both points we have modern shops.

These Mountain type engines, in the run of 888 miles, take fuel at four points en route, but the tender has sufficient fuel capacity to take oil only twice en route. The reason for taking fuel four times is to save the long haul of oil to distant points from the oil fields. These engines make long runs for water, the longest run being 160 miles from Aqua, Ariz., to Picacho, Ariz.

We now come to the question of economies in long locomotive runs, which is the subject on which I was invited to address you.

First let us show what has become of the locomotives formerly employed, particularly the excess number of locomotives required to perform the service when they were working on short runs. The Mikado engines are hauling heavy freight trains on our Salt Lake and Rio Grande divisions. The ten-wheelers are hauling 100-car freight trains on the Stockton, San Joaquin, and other valley divisions. The Pacific and Atlantic type engines have been re-assigned to valley territory where best fitted for the needs of our business.

Six months after we started to run our engines through over this 815 mile territory, we took off round house forces at the intermediate terminals to the extent of saving us $8,000 per month, or $96,000 per year. It takes no stretch of imagination to know that it requires man power to move engines to sand house, oil and water columns, and to put them across the turntable and into the roundhouse. We have saved all such roundhouse attention and handling at these intermediate terminals.

In engine house fuel, prior to the time we started to run the engines through, we consumed 66 barrels of oil per day, which at the price we were then paying for oil, amounted to a saving of $2,692 per month, or in round figures—$32,000 per year.

We have made a substantial saving in cost per locomotive mile for classified repairs. The pool of 40 engines employed before we started the long locomotive runs averaged 76,943 miles per engine between shopping periods for classified repairs. Last year the pool of 25 Mountain type engines now running through made an average of 116,827 miles per engine between shopping periods for classified repairs, an increase of 50 per cent. Some of these engines are making over 14,000 miles per month.

The cost per locomotive mile for classified repairs on the pool of engines employed in the service before we started to run the engines through was 9.203 cents, and after running the engines through with a new type of engine assigned, the cost was reduced to 7.71 cents per locomotive mile, a decrease of 16 per cent. This decrease is due in part to less abuse of the Mountain type engine on account of their adaptability to work required over this territory as compared with former type of locomotive used.

The greatest factor of decreased cost per locomotive mile for classified repairs in my judgment is the saving of the metal of the boiler. We now cool the engine down once where we formerly cooled the engine four times.

In capital investment in this one pool of engines we have saved $571,045 and with interest at 6 per cent and

E. E. Chapman
President

J. E. Davenport
Vice president

W. J. Tapp
Vice president

T. C. Hudson
Vice president

depreciation 4½ per cent, this gives us an annual saving of $59,960 per year.

Mr. Sillcox speaks on the real cost of fuel

In the opening paragraphs of his paper on the real cost of locomotive fuel, L. K. Sillcox, general superintendent motive power, C. M. & St. P., pointed out the items of expense that enter into the cost of locomotive fuel. Using the fuel performance of Class I railroads for 1925, he developed Table I, which shows the total number of equated tons of fuel reported as consumed and the charges under the various accounts.

Table I—Fuel consumption and costs for Class I railroads during 1925

Service	Tons consumed	Charges made	Cost per ton
Freight	79,367,898	.....	.....
Passenger	29,328,275	.....	.....
Mixed	1,840,343	.....	.....
Special	58,272	.....	.....
Total train	110,594,788	.....	.....
Train fuel charges	.....	$340,502,586	.....
Train power produced and purchased	.....	8,169,861	.....
Total train fuel cost	.....	$348,672,447	$3.1527
Yard fuel	22,174,755	$66,760,458	.....
Yard power produced and purchased	.....	474,041	.....
Total yard fuel	.....	$67,234,499	3.0320
Total train and yard	132,769,543	415,906,946	3.1330
Work train service	2,641,618	Distributed to other accounts	
Total tons consumed by locomotives	135,411,161	.....	.....

In explaining Table I, Mr. Sillcox said that the cost of $3.13 per ton of fuel consumed in train and yard locomotives includes the purchase price as part of the purchasing expense, the cost of inspection, the cost of any losses while being transported from the mines to the points of use, the losses in deterioration in quality or quantity owing to the time elapsing from the mines to the actual use in transportation service, the cost of labor and material operating fuel handling plants, the cost of storing and a part of the cost of accounting for the amounts used. This cost represents the fuel in the tender. It does not include the cost of maintaining scales, fuel handling facilities, power distribution lines, operating charges in connection with rolling stock needed, enginehouse expense involved, the cost of hauling freight over foreign lines and the consequent administrative features. If the real cost of fuel is to be determined, he said, it has to be traced into the firebox for the major elements involved.

In Table II, Mr. Sillcox presented the cost of maintaining fuel handling facilities.

Table II—Cost of maintaining fuel handling facilities

Fuel stations	$4,432,807
Substation buildings	52,394
Substation apparatus	277,911
Power transmission lines	312,447
Power distribution lines	2,666,975
Power line poles and fixtures	489,575
	$8,232,109

Hauling of fuel an important item of cost

Owing to the lack of actual cost figures for handling locomotive fuel at coaling stations, Mr. Sillcox estimated that an average direct labor charge of seven cents per ton is a conservative figure.

In dealing with the cost of maintaining coal and fuel tank cars as a factor entering into the cost of fuel, Mr. Sillcox estimated that 5.3 cents per ton for car maintenance should be added to the cost of fuel. In considering locomotive utilization as a factor entering into the cost of fuel, he calculated that the equivalent of 1,375 locomotives were required to haul railroad fuel during 1925. Since the records show that the average cost of repairs, depreciation and retirements per locomotive owned in 1925, was $8,146, then the total charge incurred for the 1,375 units would be $11,054,322. This would add 8.3 cents to the cost per ton of fuel. He stated further that the charge to enginehouse expense for turning these 1,375 locomotives would result in an additional cost of 3.4 cents per ton. In estimating the cost of firing locomotives in yards and in trains or conveying fuel from the tender to the firebox, Mr. Sillcox fixed this at 94.5 cents per ton.

To the items so far listed have not been added the cost of train crew expense, dispatching, maintenance of road facilities, general administration and other expenses which are difficult to set up specifically by individual accounts. The speaker estimated that these items of expense would add about six cents more to the cost per ton. The items thus far referred to were summarized in Table III.

Table III—Summary of items entering into the cost of fuel for 1925

	Cost of fuel	Cost per ton
Cost of fuel	$415,906,944	$3.132*
Maintenance of fuel handling facilities	4,508,787	.034
Freight car repairs, depr'n and retirements	7,101,580	.053
Locomotive repairs, depr'n and retirements	11,054,322	.083
Enginehouse expense	4,550,000	.034
Firing locomotives in service	125,534,000	.945
	$568,655,633	$4.282
Other operating expenses	8,041,811	.060
	$576,697,444	$4.342

* Includes handling cost at fuel stations of approximately 7 cents per ton.

Thus, the total cost per ton of coal into the firebox is $4.342. This has resulted in adding 38.5 per cent to the original unit charge-out price of the fuel.

Diesel locomotives

The Committee on Diesel Locomotives presented a very complete report of the developments in the Diesel locomotive field during the past year. This report covers the developments in both this country and in Europe and gives considerable construction and test data on the more important locomotives. The last part of the report is devoted to a partial bibliography of articles on Diesel locomotives that have been published in the technical press. All of the Diesel locomotives in service in this country at the present time and all of this type of locomotive now on order from builders in this country use electric transmission.

The Baldwin Locomotive Works is building a second experimental 1000-hp. locomotive. This locomotive will use a Krupp six-cylinder four-cycle Diesel engine. The Ingersoll-Rand, General Electric and the American Locomotive companies are building an oil-electric locomotive with a six-cylinder, four-cycle engine rated at 750 hp. at 500 r.p.m. The McIntosh & Seymour, American Locomotive and General Electric companies are also building an oil-electric locomotive with a 12-cylinder, four-cycle engine rated at 960 hp. at 325 r.p.m.

Information regarding foreign locomotives

The 1200-hp. Diesel locomotive with air transmission built by the locomotive firm Maschinenfabrik Esslingen, and described in last year's committee report, has been completed and we understand is at present undergoing tests on German State Railways. No data, however, is yet available.

The 1000-hp. Diesel locomotive with gear transmission built by the Hohenzollern Company at Dusseldorf, Germany, for Russia, was tested on a testing plant at Dusseldorf and on German roads, and sent to Russia under its own power. The tests showed that the con-

sumption of fuel at full power amounted to only .49 lb. of oil per rail horsepower-hour, this corresponding to 29 per cent overall thermal efficiency of the locomotive. The efficiency of the 1000-hp. Russian Diesel locomotive with electric transmission, it will be recalled, was about 24 per cent.

Nydquist & Hohm, Trollhattan, Sweden, has built one 300 hp. Diesel hydraulic-drive locomotive for the Uddevalla-Vanersborg railway, but there are no operating figures for publication.

One 300-hp. Diesel electric locomotive built some years ago at Deva, Vasteras, Sweden, is now in regular service between Uppsala and Enkoping, about 28 miles, with twelve station stops. The weight of the train hauled is 102 tons. The fuel oil used is 1.2375 lb. per train mile, and the lubricating oil used is .0015 lb. per train mile.

One 160-200-hp. Diesel electric locomotive built by the same firm has been in service since 1924 on the Skane-Smaland railway. The weight of the locomotive is 38 tons. The eight-cylinder Diesel-motor makes 500 r.p.m., and the locomotive is operated over a railroad having grades up to 1.67 per cent. The Diesel motor drives one generator furnishing direct current to two 65-hp. motors, each directly connected to one of the two driving axles.

During 1926 it has operated	166,564 miles
Weight of train	88 to 100 tons
Fuel oil used	.00075 lb. per ton mile
Diesel lubricating oil used	.00068 lb. per ton mile
Engine oil used	.00055 lb. per ton mile
During 1926 it has been in for general repairs	54 days
During 1926 it has been out of service for running repairs	17 days
During 1926 it has been cut of service account too light to handle heavy train	1 day
During 1926 it has been in service	293 days

Mr. Rosen, a Swedish engineer, is still experimenting with his hydraulic transmission on the 300-hp. locomotive that was built in 1925, and which is still in regular service.

Diesel locomotives in the United States

The report included a list of 19 Diesel-electric locomotives that are now being operated or are on order by railroads in the United States. The oldest locomotive shown in this list is the 60-ton oil-electric locomotive built by the Ingersoll-Rand, General Electric and the American Locomotive Companies for the Central of New Jersey, which was delivered in October, 1925. The report states that this list is complete except for several locomotives of special design. One eastern railroad included in the list has on order three Diesel engine-driven locomotives. These locomotives are of special design, as shown in Table I.

Table I—General dimensions of three Diesel locomotives now on order for an eastern railroad

Service	Freight	Passenger	Switch
Wheel arrangement	4-8-4	4-8-4	0-4-4-0
Weight on drivers, lb.	164,000	180,000	250,000
Total weight of locomotive, lb.	290,880	348,000	250,000
Total length overall	51 feet 7 inches	59 feet 4 inches	46 feet 8 inches
Driving wheel base	17 feet 6 inches	18 feet 6 inches	8 feet 3 inches; 34 feet 1 inch
Total wheel base	42 feet 10 inches	49 feet 4 inches	34 feet 1 inch
Maximum speed, m.p.h.	45	60	40
Maximum tractive force	41,000 lb.	45,000 lb.	62,500 lb.
Engine, cycle	4-stroke	4-stroke	4-stroke
Builder	Ingersoll-Rand	McIntosh & Seymour	Ingersoll-Rand
Brake horsepower	750	960	300
Revolutions per minute	500	325	600
Cylinders, diameter and stroke, in.	14¾ by 16	14 by 18	10 by 12
No. of cylinders	6	12	6
Weight of engine, lb.	45,000	80,000	20,125
Kind of fuel inj. system	Solid	Air	Solid
Main power generator, voltage	460	485	500
Storage batteries, type	E.S.B.Co.	E.S.B.Co.	E.S.B.Co.
Capacity	150 a.h.	150 a.h.	680 a.h.
Axle motors, number	4	4	4
Type	GE-286-A	GE-286-A	GE-286-A
Capacity	395 hp.	395 hp.	395 hp.

A second eastern railroad is now building in its own shops, as referred to in the first part of this report, three Diesel electric locomotives, the principal dimensions and data of which are as follows:

Type	0-4-0
Length over couplers	26 ft. 10½ in.
Wheel base	10 ft.
Wheel diameter	50 ft.
Weight	130,000 lb.
Tractive force	40,000 lb.
Oil engine	Bessemer 500 hp., 800 r.p.m., 4 cycle
Fuel injection	Solid
Cylinders	8, 8½ in. bore by 12 in. stroke
Main generators	Westinghouse 325-kw., 580 volts
Motors	2 Westinghouse, 225 hp. each
Gear ratio	16.76

A third eastern railroad has on order a Diesel locomotive which is now being built by Krupp in Germany, of which the general dimensions and data are given in Table II.

The committee sent a questionnaire to the different railroads operating Diesel locomotives requesting information as to the cost of operation and maintenance and the kind of service rendered. All of the replies gave data on Diesel or oil-electric locomotives used in switching service only, which varied from light to heavy. Although the committee found it difficult to obtain comparable figures relative to operation or maintenance costs, the replies to the questionnaire did give a large amount of valuable information. The railroads replying to this questionnaire were designated by the letters A, B, C, etc., and the reports from some of these are shown in Tables III and IV.

Table II—Dimensions and general data of the Diesel geared locomotive built by the Friedrich Krupp Works, Essen, Germany

Type	4-8-4
Weight on drivers	200,000 lb.
Total weight	314,000 lb.
Wheel base, rigid	17 feet 0 inch
Wheel base, truck	6 feet 6 inches
Total wheel base	44 feet 1 inch
Diameter of driving wheels	61 inches
Tractive force at 7½ m.p.h.	50,000 lb.
Factor of adhesion	4
Maximum curve	16 deg.
Maximum speed	60 m.p.h.
Engine	Six cylinders, single acting, four-cycle, solid injection, not less than 1,300 b.h.p. at 470 r.p.m.
Transmission	Mechanical, 4-stage gear system

Table III—Service record of one 60-ton, 300-hp. oil-electric locomotive reported by road "C"

Kind of service and operating conditions	Shifting and drag
Hours operating per day	23½ hr. each week day and 8 hr. on Sundays
Total hours per week	149
Cost of fuel oil, lubricating oil, gasoline, etc.	$1,703.23
Cost of maintenance	$2,036.78
Kw.-hours generated	31,056
Cost per kw.-hour generated	$0.1204
Hours of locomotive service	4,673
Cost per hour of locomotive service	$0.8003
Number calendar days out of service for inspection, repairs or material	20

Summary of Operation Oil-Electric Locomotive vs. Steam Locomotives It Replaced

Time	June 18, 1926, to Feb. 28, 1927	
Number of days	256	
Hours of locomotive service	4,673	
Total number miles at 6 m.p.h.	28,038	
	Oil-electric	Steam
Interest on investment—256 days	$2,567.01	$1,490.69
Depreciation	1,900.71	747.68
Crews' wages	6,261.82	7,086.45
Cost of fuel, oil, coal, etc.	1,703.23	4,808.52
Cost of maintenance	2,036.78	3,364.56
Total cost of operation	$14,469.55	$17,497.90
Total cost of operation per mile	$.515	$.624
Hourly operating average		
Interest on investment	$.550	$.319
Depreciation	.407	.160
Crews' wages	1.340	1.515
Cost of fuel, oil, coal, etc.	.364	1.029
Cost of maintenance	.435	.720
Total cost per hour	$3.096	$3.743

Saving in favor of oil-electric locomotive: $.647, or 17.3 per cent.

Last year's report indicated that for every dollar expended for fuel oil for the Diesel engine $.233 was spent

for lubrication. The operating costs reported this year indicate that the cost for lubricating oil was about $.248 for every dollar expended for fuel oil.

Some means of filtering the lubricating oil should be provided on the locomotives to purify the oil and thus make it possible to extend the time between changes. This should materially reduce the cost of lubrication for Diesel engines.

Table IV—Service record of one 100-ton, 600-hp. oil-electric locomotive

Switching service. Operating conditions good.
During January operated 371 hours— 8 days worked three shifts
11 days worked two shifts
4 days worked one shift

Cost of fuel oil	$114.90
Cost of lubricating oil	30.30
Cost of gasoline, for starting engine	2.63
Cost of supplies	6.64
On all the above amounts there is a storage charge of 6 per cent.	
Cost of maintenance	$201.50
The cost of maintenance was high during January on account of changes that were being made at that time.	
Kw.-hours generated	24,700

Comparison Cost in Cents per Mile Run

(371 hours' service performed in January at 6 miles per hour in switching service, 2,226 miles.)

	Steam	Oil-electric
Fuel	40.00	5.17
Repairs	7.75	12.29
Wages	29.81	29.84
Enginehouse expense	8.86	5.43
Lubrication	.40	1.36
Other supplies	.82	.41
Total	87.73	54.50

The comparative cost per mile run is 33.23 cents in favor of the oil-electric locomotive.

	Locomotive	Oil-electric
Tractive force	58,500 lb.	60,000 lb.
Weight on drivers	232,600 lb.	209,500 lb.
Total weight engine and tender	375,500 lb.	209,500 lb.
Weight on drivers ÷ tractive force	3.98	3.47
Superheated	Yes	.....

The report was signed by L. P. Michael, (C. & N. W.) chairman; E. J. Brennan, (C. G. W.), L. G. Coleman, (Ingersoll-Rand Company), Harte Cooke, (McIntosh-Seymour Company), J. E. Davenport, (N. Y. C.), R. M. Dilworth, (Electro-Motive Company), A. H. Ehle, (Baldwin Loco. Works), H. Gardner, (Steamotor Company), A. I. Lipetz, (American Locomotive Company), C. E. Lucke, (Columbia University), J. K. McNeillie, (D. & H.), R. J. Needham, (C. N.), J. M. Nicholson, (A. T. & S. F.), C. A. Norman, (Ohio State University), Clarence Roberts, (Penna.), F. E. Russell, (S. P.), C. B. Smith, (B. & M.), Carl Uddenberg, (Swedish Government Rys.), and W. H. Winterrowd, (Lima Locomotive Works).

Committee reports were also presented on the following subjects: Preparation of coal and fuel oil, Malcolm MacFarlane (N. Y. C.), chairman; Fuel accounting, storage of coal and fuel oil, Glenn Warner (P. M.), chairman; Stationary power plants, R. S. Twogood (S. P.), chairman; Fuel stations, L. J. Joffray (I. C.), chairman; Locomotive firing practice, J. M. Nicholson (A. T. & S. F.), chairman; Co-operation with American Railway Association, Eugene McAuliffe (U. P.), chairman; Co-operation with the Railway Accounting Officers Association, B. A. McDowell (Baltimore & Ohio), chairman.

Report on locomotive economy devices

The improved performance of a number of new locomotive designs recently tested reflects the combined effect of an aggregation of devices most of which have come into practical use on American locomotives since the advent of the feedwater heater.

A good example can be found in the performance of 15 locomotives of the 2-10-4 type with feedwater heaters, superheat for auxiliaries, boosters, rail-washers, thermic syphons, limited cut-off and designed for 250 lb. working pressure, enlarged grate area and four-wheel trailer trucks, compared under the same operating conditions with the performance of 36 locomotives of the 2-10-2 type, designed for a working pressure of 200 lb. and not equipped with the devices and features above referred to.

Both groups of locomotives have 63-in. drivers. The cylinders of the newer locomotives are 29 by 32 in., compared with 28 in. by 32 in. on the older locomotives. The new locomotives, designated as the Texas type, weigh 150 tons on the drivers compared with 133 tons weight on the drivers of the older locomotives.

The committee is indebted to the Texas & Pacific for the following statistics in the table covering the operation of both groups of locomotives for the calendar year 1926.

The difficulty of finding two such groups of locomotives operating under conditions that afford a valid comparison can be appreciated.

Direct steaming—Locomotives at terminals

The reason the committee has given attention to the problem of the direct steaming of locomotives at terminals is that the percentage of fuel consumed at terminals is constantly rising until it is estimated by some roads to represent from 25 to 40 per cent of all locomotive fuel. During the past year the Grand Trunk Western and the Chesapeake & Ohio conducted experimental tests of direct steaming systems.

In the direct steaming systems locomotives are held under steam by direct connection to a high-pressure steam main from a stationary boiler plant and when the locomotive boiler is emptied in the enginehouse it is refilled with a mixture of hot water and steam which flows into the boiler until a working steam pressure has been developed without a fire on the grates. Provision is also made for salvaging surplus water that accumulates in the locomotive boiler while it is being steamed up or held under steam. With this system it is not necessary to light the fire on the grates until the locomotive is ready to leave the terminal and if it is desired to eliminate all fires in the enginehouse the locomotives are moved out under their own steam and placed on the ready track before the fires are ignited.

Under ordinary operating conditions at Battle Creek, the Grand Trunk Western has found this system to be the most practical means for smoke abatement at its Chicago enginehouse. The committee is advised that the Chicago & North Western and the Big Four have com-

Comparison of the fuel consumption of Texas Type (2-10-4) and 2-10-2 Type Texas & Pacific locomotives

	Marshall dist.		Longview dist.		Dallas dist.		Ft. Worth dist.		Baird dist.		All districts	
	Texas type	2-10-2 type	Texas type	2-10-2 type	Texas type	2-10-2 type	Texas type	2-10-2 type	Texas type	2-10-2 type	Texas type	2-10-2 type
Total mileage	8,542	33,811	3,529	133,766	90,367	331,525	191,237	203,581	168,653	67,341	462,328	770,024
Average tons per train mile	3,005	2,497	2,899	2,181	2,390	1,854	2,244	1,617	2,224	1,546	2,285	1,850
Per cent engine utility	62.6	73.4	85.3	82.3	79.7	84.3	78.1	78.9	67.4	65.8	73.9	80.3
Gallons oil per 1,000 g.t.m.	6.9	11.2	6.4	10.5	6.9	10.7	7.3	12.3	7.4	11.0	7.2	11.1
Per cent reduced fuel consumption	38.4	.....	39.0	....	35.5	....	40.6	....	32.7	....	35.1	....
Per cent increased train loading	20.4	.....	32.9	....	28.9	....	38.8	....	43.9	....	23.5	....

pleted plans for the installation of the direct steaming system on a large scale for the purpose of smoke abatement in enginehouses at Chicago and Cincinnati.

From the standpoint of fuel economy at the terminal the results depend upon the steam consumption required to steam up and hold locomotives under steam by means of stationary boilers in place of fuel burned on the grates while the locomotive is standing in the enginehouse.

In the tests referred to it was established that from 4,500 to 6,000 lb. of steam hour is the maximum requirement at the time the boiler is being refilled after being washed out or water changed, this figure being based on steaming an engine from empty to stationary boiler plant pressure in from one hour to one hour and twenty minutes. Provided more time can be allowed for filling and steaming the maximum steam consumption can be cut down in direct proportion to the time required to bring the engine up to maximum pressure.

Where the stationary boiler plant pressure is 150 lb. and it is desired to hold locomotives at a minimum of 125 lb. pressure, it has been found that a ½-in. by-pass at each direct steaming station permits sufficient steam flow to maintain this pressure, which represents a maximum demand upon the stationary boiler plant of 30 b.hp. per hour, it being understood that this takes care of ordinary fluctuations encountered. However, while it has been found that the maximum required for holding engines is at the rate of 30 b.hp. for each engine on the line, actual experiments show that if the stationary boiler pressure can be maintained at a fairly uniform rate, the hourly consumption per locomotive will average about 10 b.hp. per hour.

With an average stationary boiler plant coal consumption of 4½ lb. per boiler horsepower-hour, the fuel required to hold a locomotive under steam in the enginehouse by the direct steaming system is about 45 lb. of coal per hour. A further economy is possible where a cheaper grade of coal can be utilized in the stationary boilers than required for locomotive use. As has been stated in previous reports, the use of stack blowers in the enginehouse represents a steam consumption variously estimated at from 40 to 80 boiler horsepower per hour. With the direct steaming system the enginehouse blower is eliminated except for occasionally cooling down the boiler when necessary for work in the firebox.

Steam consumption test

Filling and steaming locomotive 5,039, Battle Creek Dec. 3, 1926

Time	Pressure steam at booster	Loco. gage pressure	Steam flow, lb. per hr.	Remarks
11:40 a.m.	115	0	5,250	Start to fill locomotive with water at temperature of 180 deg. and steam from boiler plant
11:55 a.m.	115	10	6,000	
12:04 p.m.	105	25	5,500	Close water line valve, one gage water in boiler
12:30 p.m.	115	62	5,500	
12:45 p.m.	117	80	5,000	
1:00 p.m.	125	95	3,750	
1:20 p.m.	125	120	3,000	Booster steam valve closed to ⅛ turn
1:45 p.m.	135	130	1,500	

Steam consumption test

Holding steam pressure on locomotive 5,039, Battle Creek, Dec. 4, 1926

Time	Boiler plant pressure	Loco. gage pressure	Wat'r glass reading inches	Remarks
8:30 a.m.	136	137	5¼	Booster steam valve closed to ⅛ turn
9:30 a.m.	135	135	6	
9:45 a.m.	140	132	6	
10:00 a.m.	125	127	5¾	
10:15 a.m.	135	130	6	Note: Rise of water from 5¼ in. to 7 in. above crown sheet in locomotive 5,039 represents condensation of steam delivered to locomotive boiler at rate of 189.4 lb. per hour.
10:30 a.m.	145	132	6½	
10:45 a.m.	135	131	6¼	
11:00 a.m.	140	132	6½	
11:15 a.m.	140	133	6¾	
11:40 a.m.	140	134	7	

Heating feedwater in tenders

A number of roads are obtaining a small saving by reclaiming the heat in the air pump and stoker engine exhaust by passing it into the water in the tender. To prevent overheating some form of thermometer is provided and when the maximum temperature desired is reached, the exhaust is turned into the stack. The equipment required can be applied to an engine with small cost and with little subsequent maintenance.

The report contained descriptions of the equipment used by the U. P. and B. & M. for heating feedwater in tenders.

A number of test runs have been made with the B. & M. equipment and the results of two runs in May, 1926, are given in the table:

Results of tender feedwater heating on the B. & M.

	Run No. 1	Run No. 2
Tank water temperature	49½ deg.	47 deg.
Temperature of atmosphere	61 deg.	65 deg.
Temperature of suction water	*118.4 deg.	107.7 deg.
Boiler pressure average	179 lb.	172.6 lb.
Back pressure on compressor	3.6 lb.	4 lb.
Average water used per hour	16,740 lb.	15,160 lb.

* Temperature considered too high for positive operation of lifting injector.

Heating the water in the tank results in a saving of from three to four per cent of the fuel used by the locomotive.

Front end or smoke box throttles

On a modern medium weight Mikado locomotive operating trains of from 90 to 110 cars, and having an 8½-in. cross-compound compressor, feedwater pump, long cut-off booster, stoker engine, and headlight generator, the auxiliaries will use from 11 to 13 per cent of the total steam generated. For shorter trains, with less train line leakage, this might be reduced to from 10 to 12 per cent. Without the booster, the proportion would be about 7 to 10 per cent. A fair range would be from 7 to 13 per cent for ordinary conditions with an average of about 10 per cent. Consequently, it may be said that in general the use of superheated steam for the auxiliaries of a steam locomotive will result in a saving of from 2 to 4 per cent of the fuel used by the locomotive. The front-end or smokebox throttle makes such use of superheated steam possible and convenient.

The report continued with a description of the multiple front-end throttle which was described on page 1793 in the June 14, 1926, daily edition of the *Railway Age*.

The increasing use of rail motor cars has led to the development of air-operated whistles of sufficient calibre for steam railway requirements and several roads are experimenting with this type of whistle on locomotives. A recent test on the Union Pacific indicates that there is a fuel saving from the use of air whistles in place of steam whistles of about $1.15 per locomotive per day in passenger service between Omaha and Cheyenne. On this road it is the practice to whistle for the operator's signal at each station and acknowledge the clear signal, but on the other hand the grade crossings for which the crossing signal must be blown are less frequent than in other sections where the fuel saving would be greater.

The report was submitted by George E. Murray (Grand Trunk Western), chairman; E. A. Averill (Superheater Co.); J. N. Clark (S. P.); L. E. Dix (T. & P.); L. D. Freeman (C. & O.); A. G. Hoppe (C. M. & St. P.); J. R. Jackson (M. P.); V. L. Jones (N. Y., N. H. & H.); Elmer Kuhn (N. Y. C. & St. L.); J. M. Lammedee (Worthington Pump & Machinery Corp.); G. H. Likert (U. P.); L. P. Michael (C. & N. W.); F. P. Pfahler (S. A. L.); L. G. Plant (Ry. Engineering Equipment Co.); W. A. Pownall (Wabash); H. W. Sefton (C. C. C. & St. L.); S. R. Tilbury (A. T. & S. F.), and G. A. Young (Purdue University).

The Reader's Page

Further discussion on setting the Walschaert valve gear

LEXA, Arkansas.

TO THE EDITOR:

On page 235 in the April issue of the *Railway Mechanical Engineer,* Mr. L. K. Botteron of the Santa Fe took exception to my method of setting the Walschaert valve gear as described on page 765 of the December, 1926, issue of this paper.

I admit that Mr. Botteron is right that I should not have trammed from the link foot pin, but from the center line of the link slot. A small iron plate can be secured to the bottom of the link by the link cheek bolts so that the link slot center line or arc *I-I* may be carried down to intersect the arc *J-J* on the surface of the plate. The arc *J-J* has for its radius *S*, the distance from the link trunion center to the link foot center. The arc describes the path of the link foot pin.

With a short adjustable tram set to the radius *S*, a short arc is scribed across this plate. Then, while the link is locked in the neutral position and with the tram set to the radius of the link and swinging the tram from the center of the front radius rod pin, another arc is described on this plate. A punch-mark is made at the point of intersection of the two arcs, and this is used to tram from in determining the eccentric rod length and the eccentric crank location.

While the link is still locked in the neutral position, a tram of suitable length is swung from the punch mark on the plate, scribing an arc across the cylinder jacket near the top of the valve chamber and extending down to a point approximately at the center of the cylinder.

A line *H-H* is now located diagonally across the valve chamber jacket by taking a chalked string stretched from the tramming point on the link plate to a point on the valve chamber jacket, in such manner that the string is approximately parallel with the radius rod when it is at the bottom of the link. While this location is not absolutely accurate with reference to the difference of angularity of the tram when tramming from each extremity of the link swing, the difference would be so slight as not to be considered in general practice. On the drawing the line *H-H* is correctly located, as it is an extension of the chord *B-F*.

The dead center mark *O* is located at the point where the line *H-H* bisects the tram mark that was swung from the link foot. The eccentric rod length is then determined in same manner as in the original article and the eccentric crank is located by adjusting it so that *B-F* equals the dimension as set forth on the erecting card.

I believe that if this method were followed out, satisfactory results would be obtained and much labor of pinching and figuring would be eliminated.

L. V. MALLORY,
Division foreman, Missouri Pacific.

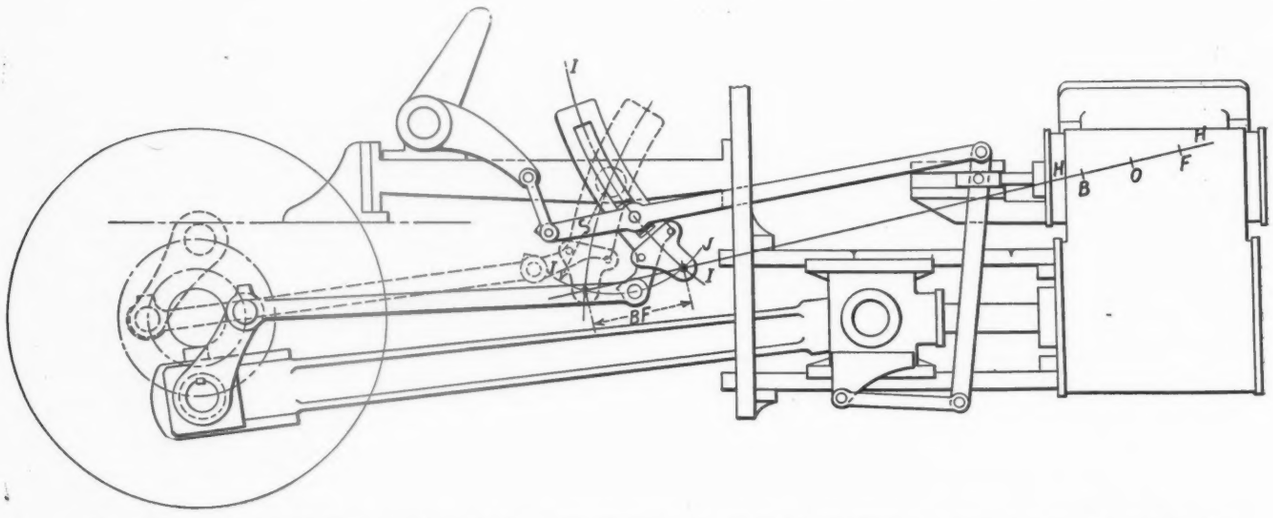


Diagram showing how to determine the dead center mark O by working from the center line of the link slot

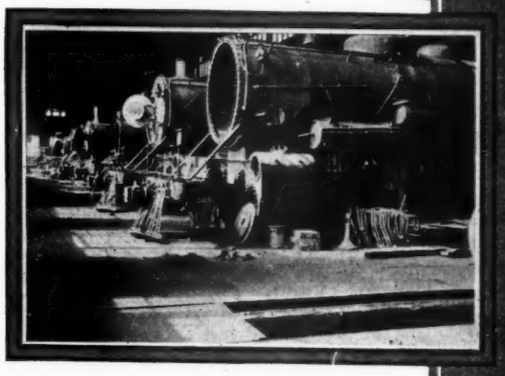
Applying cross-key yokes---an answer

MINDEN, La.

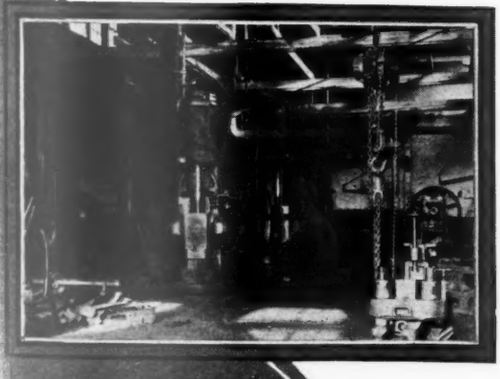
TO THE EDITOR:

In answering to "A Reader's" question on the Reader's Page of the May issue of the *Railway Mechanical Engineer,* it is my opinion that A. R. A. Rule No. 88 would apply and that the defect card should be issued for labor only to cover the coupler and yoke.

J. B. SEARLES,
General car foreman, Louisiana & Arkansas.



New and Improved Machine Tools — and — Shop Equipment

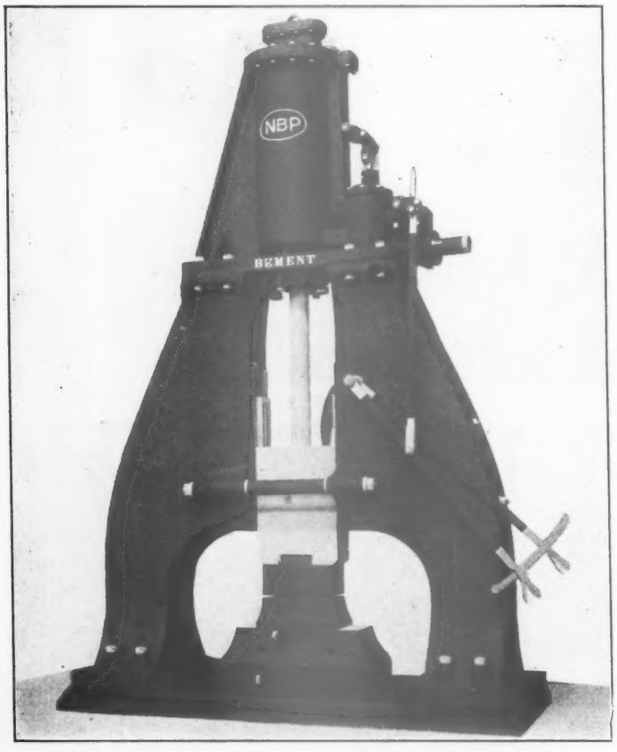


Niles double frame steam hammer

A LINE of entirely redesigned double frame steam hammers has recently been put on the market by the Niles Tool Works Company Division of the Niles-Bement-Pond Company, Hamilton, Ohio. These hammers range in capacity from 3,500 lb. to 8,000 lb.

In designing these hammers it has been the aim of the builder to produce a machine of greater efficiency and owing principally to improved valve and steam passage design it has been possible to obtain 30 per cent greater speed in operation than in the former design. Furthermore, the use of forged and cast steel has been adopted as far as possible for the main members and the conventional design of cylinder and frames has been departed from to secure additional strength. The hammer is of the double acting type, taking steam above and below the piston and the length of stroke, position, speed and intensity of blows are controlled either automatically or by hand by two levers, one controlling the operating and the other the throttle valve.

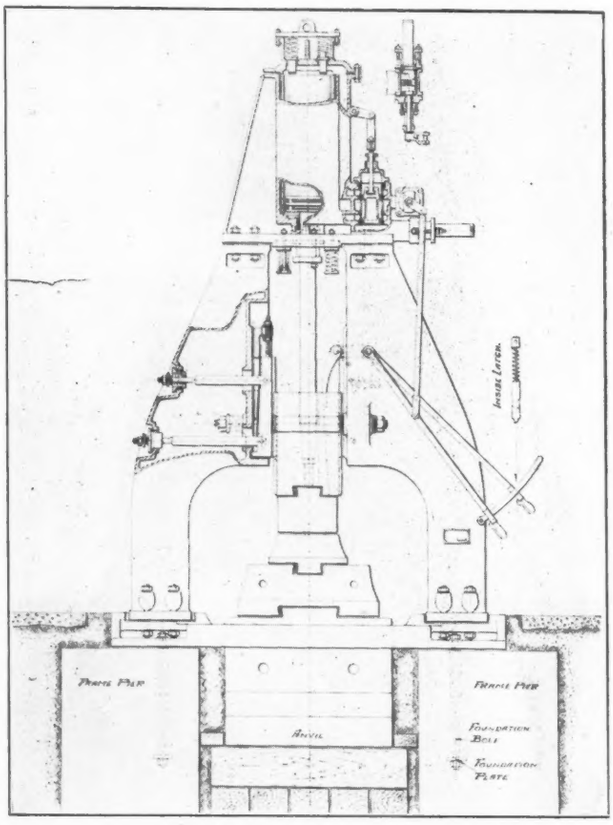
The cylinder is a steel casting fitted with an iron renewable liner, pressed into position, and is lipped down between the frames and held to them by eight bolts fitted into reamed holes. The bolts are of special alloy steel of high tensile strength. The throttle and operating valve



A Niles 4,000-lb. double frame steam hammer

chests are cast integral with the cylinder and the whole unit is self draining. A safety cover is bolted on top of the cylinder and contains two heavy helical springs with bumpers projecting into the cylinder which act as a cushion, so placed as to come in contact with the piston at its highest position. Springs are also furnished on the under side of cylinder for the same purpose. A pump is furnished for the adequate lubrication of the cylinder unit.

The operating valve is of the balanced piston type, working in a renewable liner fitted in the cylinder. The vertical motion of the valve by which steam is admitted, cut-off and exhausted, is controlled by a cam bearing on an incline in the ram. As there is no rigid connection, the valve and gear are not subjected to violent shocks. The throttle valve is of the rotary type operated by a lever to admit steam through the center, reducing friction



A cross-sectional view of the Niles double frame steam hammer

and wear to a minimum. The piston is forged integral with the rod and is of nickel steel.

The piston can be raised above the top of the cylinder for examination or renewal of rings without separating the ram from the rod. The ram is made of carbon open hearth forged steel. The piston rod is fitted into a taper hole in the ram and a safety pin is provided to hold the ram and rod together.

The frames are heavy steel castings of box section. Greater depth of section and improved appearance are attained by the elimination of the usual curved frame design and the employment of a straight line profile blending into a large radius towards the hammer base. They are lipped in the base and held together by tie bolts and distance pieces. They are held down on the base plate by eight large bolts of special alloy steel, fitted in reamed holes.

The guides have a shoulder at the bottom so arranged that they cannot move vertically, but are free for horizontal adjustment by means of a wedge which can be suitably locked after the adjustment is made. The guides and wedges may be removed without separating the ram from the piston rod. The guide bolts are held to the guides by pins, and as these bolts are not required to

carry the weight, they are free from vibration.

The anvil is a close grained iron casting entirely independent of the base plate. The anvil cap is an annealed open hearth steel casting and is keyed to the anvil and can be removed without disturbing the hammer. The anvil is provided with a tongue instead of the usual notch and the anvil cap is notched at the bottom to correspond, thus eliminating the usual source of broken anvils due to the lack of attention to keys. The anvil cap, being of steel, offers greater resistance to breakage.

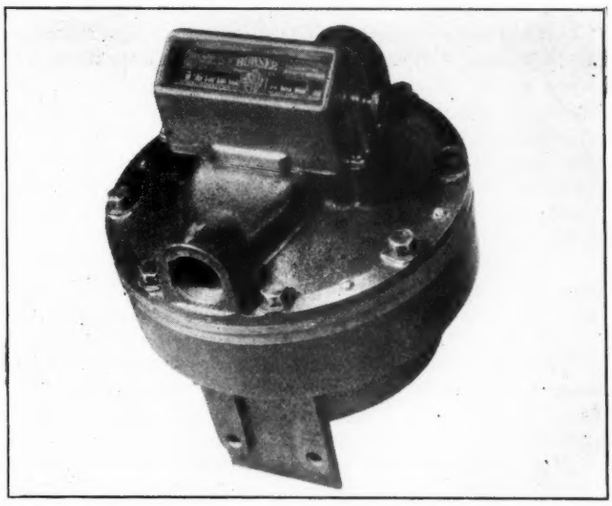
Displacement recording meter for liquids

A REGISTERING meter, operating on the principle of positive displacement, has been developed by S. F. Bowser & Company, Inc., Fort Wayne, Ind. It is especially adaptable for fuel oil installations for locomotives, for emptying tank cars into basement tanks and for engine terminal oil houses.

The oil flows into the meter and is measured in five cylinders, arranged in a circle. The five pistons which operate in the cylinders are connected to a wabbling plate and as the oil displaces the pistons the motion of the shaft records the displacement. When one cylinder is filled, the liquid is discharged while the next is being filled, and so on around the circle of cylinders.

As may be seen to the left in the illustration, the meter has a totalizer which records up to 100,000 gallons and then repeats. This portion of the meter record cannot be changed. To the right is a set-back counter which records up to 1,000 gallons. This portion of the meter can be turned back to zero at the beginning of any particular operation.

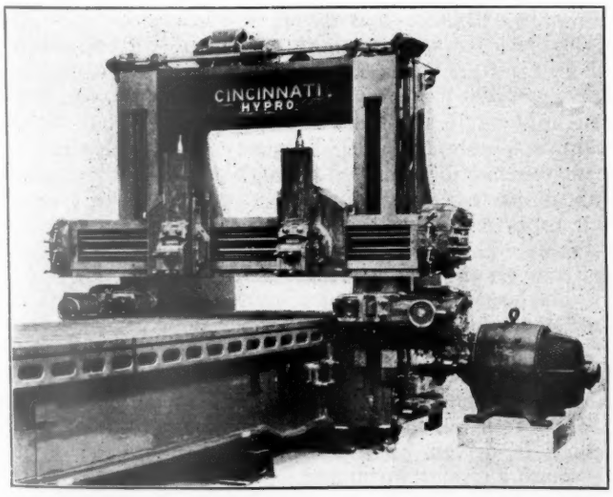
The meter is furnished in four sizes. Nos. 2, 3 and 4 are equipped with continuous counters recording up to 100,000 gallons and then repeating, with set-back counters recording up to 1,000 gallons and then repeating. The set-back counter can be equipped with a 1/10 gallon wheel. The No. 5 meter is equipped with continuous counter recording up to 1,000,000 gallons and then repeating, and with a set-back counter recording up to 10,000 gallons and repeating.



The Bowser automatic recording meter for measuring the flow of liquids

Duo control for large planers

THE Cincinnati Planer Company, Cincinnati, Ohio, has recently made a change on its large type machines, so as to enable the workman to operate the planer from either the right or left side.



Cincinnati planer provided with complete controls on both sides of the machine

The down slides on the rail heads are independent of each other and also eliminate the sliding of gears and clutches back of the saddle. The gears are always in engagement. This requires two feed rods to the rail which makes it possible to be feeding the one slide while the rapid traverse is operating on the other slide. There is a duplicate set of levers on the left side of the planer. This means that it is possible to engage the rapid traverse or the feed to raise or lower the rail or to loosen or clamp the rail from the left side of the planer.

On large machines, there is quite an advantage of operating the machine from either side. In many instances, there are two operators on the machine and therefore, the man that is using the left side can control the left head from the left side without asking the operator on the right side to assist him. This should reduce the set-up time and also the time lost between cuts. In case there is only one operator on the machine, and he should happen to be on the left side of the planer, he can raise and lower the rail at will and loosen it and clamp it and move the heads and engage the feed without moving around to the right side of the machine.

A support to the harp has been embodied in the machine. The illustration shows that an extension is cast on the top of the saddle and that the harp is held to this by a clamp. This will assist considerably when reaching down below the bottom of the rail with the

slide. On the old construction, the harp was bolted to the saddle by four bolts which were very close to the center, giving a very small leverage. With the additional clamp on the top of the saddle, the leverage has been increased and consequently will hold more securely to the saddle.

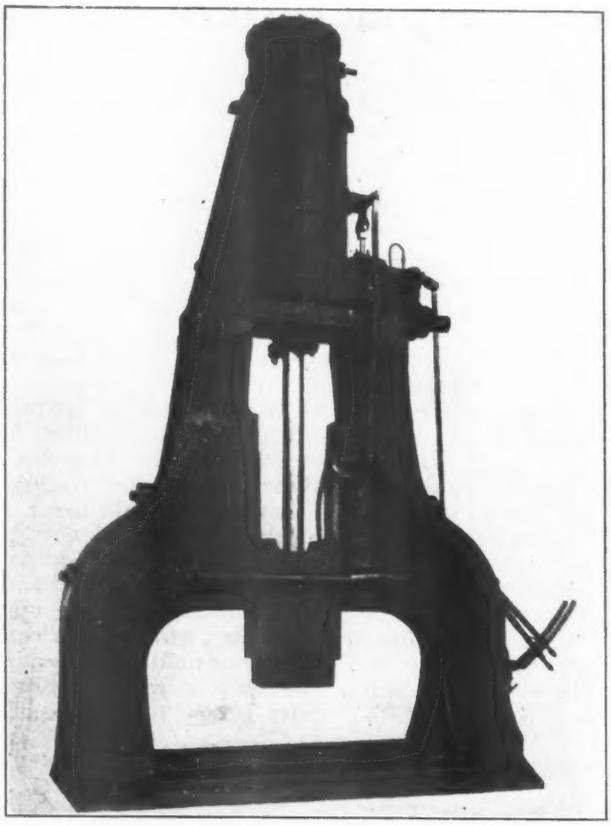
Chambersburg steam hammer

THE method of fastening the frames to the cylinder on steam hammers built during past years, depended entirely on the cylinder and frame bolts to hold the cylinder in line with the ram guides. The side thrust was taken in a small lip located on the outside of the cylinder casting and the base plate. On the new design of hammers now manufactured by the Chambersburg Engineering Company, Chambersburg, Pa., these lips have been eliminated and in their stead, large thrust shoulders are located in the joints between the cylinder and the frame and between the frame and the base plate bearings. On the bottom of the cylinder, the projection is finished on three sides and fits into a finished recess at the top of the frame, locking the cylinder in all directions and permanently maintaining alinement with the guides in the frames.

The frame and cylinder bolts are no longer bodybound and the cylinder lock has many times the bearing surface and strength of the bolts which now pass through clearance holes.

The Chambersburg hammers are fitted with a keyless valve cam. This construction does away entirely with keys in the valve gear and eliminates any lost motion usually due to keys on connections.

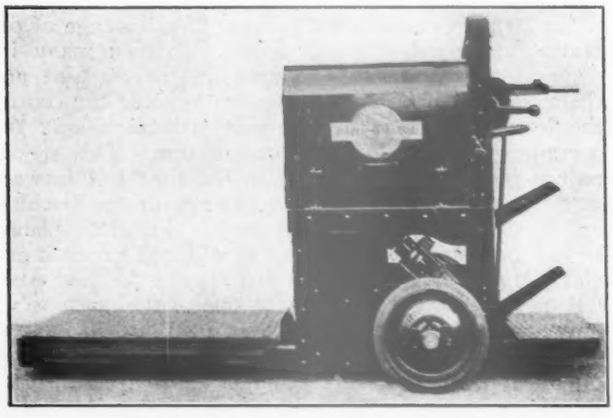
The ram guides are now supported at the top and bottom and fit snugly in the sides and back of substantially constructed pockets. The adjusting gib or shoe is fully supported and adjusted by heavy tee-bolts arranged with positive locks. The frames are further reinforced and held together by heavy tie rods which project beyond the valve mechanism. The throttle is of the rotary type and the operating valve is balanced and so constructed that should any connection break or loosen, the valve will drop and close the line steam ports even though the throttle valve is wide open.



The Chambersburg double frame steam hammer is now fitted with a keyless valve cam

Electric truck for handling small material

COMPACTNESS, adapting it for use in congested railroad shops, is a feature of an electric truck named the Crescent Star, which is now manufactured by the Crescent Truck Company, Lebanon, Pa. The truck has been developed primarily for use with the 7-in. hand-lift truck skids and has a capacity of approximately 2,500 lb. The width is 30 in. overall, the length 82 in., overall, and the weight, with a nine-plate battery, approximately 1,525 lb. Because of its small width, the machine may be operated through a 32-in. doorway, and its compactness and light weight permit it to be taken on elevators which are too small for the heavier type machines. This is a desirable feature for operating in railway shops.



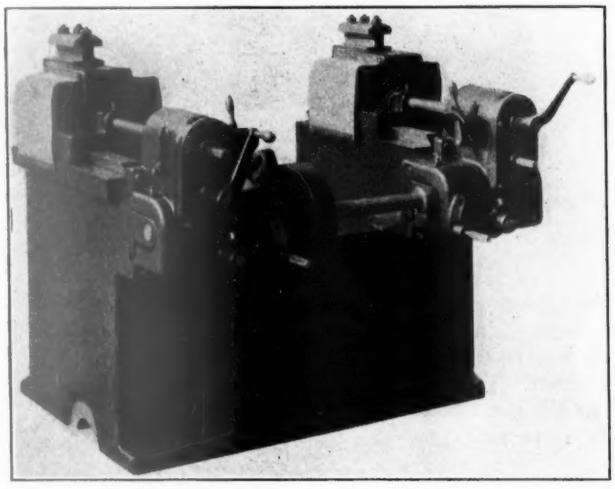
This electric truck may be run through a 32-in. doorway

The speed of the machine, light, is six miles per hour, and loaded, four to five miles per hour. The turning radius is 7 ft. 6 in. The lifting mechanism is actuated by a foot pedal and this mechanism, for which patent has been applied, is said to enable an operator weighing 135 lb. to lift a load of approximately 3,500 lb. The machine is driven by a 24-volt General Electric motor through a straigt worm and worm wheel reduction. The driving tires are 3½ in. by 15 in. and are of the pressed-on automotive type. The trailing tires are of steel and are 3 in. by 6 in. in size.

Journal turning and quartering machine

THE illustrations show a 90-in. Putnam journal turning, quartering and pin turning machine sold by Manning, Maxwell & Moore, Inc., New York, which may also be equipped to turn the journals on inside crank axles of three-cylinder locomotives.

A face plate is mounted on the forward end of the main spindle. Two movable counterweights are set flush with the surface in a circular trough formed in the faceplate, thus eliminating all projections. These weights are arranged so that they may be adjusted independently and clamped in any desired position. A gear ring is set in the bottom of the trough and each weight contains a pinion engaging this gear. The outer end of each pinion shaft is squared for the reception of



Front view of compound rest for turning journals on inside crank axles of three-cylinder locomotives

a ratchet socket wrench. Each weight is also fitted with a pawl engaging the gear ring to prevent the weights from running down the trough when the clamping bolts are released. The ratchet wrench is used for moving them. The pawl is manipulated by a knob set in a depression in the face of the counterweight and held in mesh with the gear ring by a spring plunger. An additional stationary lead counterweight is cast into pockets on the rear side of the faceplate, the total available counterweighting effect being sufficient to balance the heaviest driving wheel sets. By movable counterweights, the faceplate can be put in balance for turning trailer journals.

The driver is of the crank pin type. It is in the form of a vise the jaws of which are mounted one on either side of the crank pin opening in the faceplate and are operated by a tee-handled socket wrench either from the front or rear of the lathe. The jaw-operating screws are geared together so that the jaws open and close symmetrically about the center. This feature insures the wheel sets being held in exactly the same position each time they are placed in the lathe, enabling the operator to establish locating points for the movable counterweights to suit the various sizes of wheel sets handled. The jaws are faced with copper to prevent marking the pins.

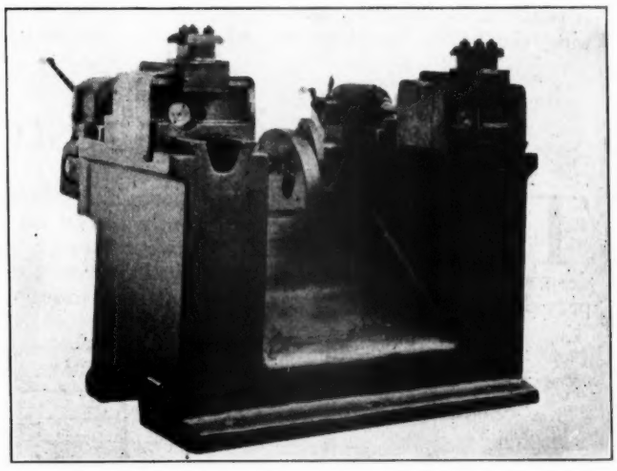
For handling trailer sets, a pair of extension jaws or fingers are furnished which engage a spoke in the wheel center. These extension jaws are bolted to the outer face of the regular driver jaws and are adjustable in and out from the center to suit the various sizes of trailer wheel centers.

The head and tailstocks are of liberal proportions, both being adjustable along the bed by separate motors geared to the traverse screws. They are each clamped by two large bolts on the front and two on the back which engage tee-slots in the bed. The bolts are set up by two wedges, actuated by right and left hand screws, thus equalizing the strain on each bolt. The device is operated from either side of the lathe by a ratchet wrench and quickly clamps the headstock or the tailstock to the bed, a separate clamp being provided on each. The adjustable spindle in the tailstock carries a center mounted on ball and roller bearings. A live center in the headstock and a revolving center in the tailstock insures the turning of true journals.

On the double carriage base are mounted two carriages for the turning and burnishing of the longest inside journals and for facing the largest hub liners. Each carriage has indpendent, reversible, power longitudinal and cross feeds. Tools may, therefore, be fed in the same or opposite directions on the two journals or hub liners, or one tool may be turning a journal while the other is facing a hub liner.

For turning outside trailer journals, there is a single carriage base located adjacent to the tailstock, one journal being turned at a time. The power longitudinal and cross feeds are also reversible on this carriage.

This machine can be arranged for single or double



Rear view of the compound rest for turning the journals on inside crank axles of a three-cylinder locomotive

quartering. When the double quartering attachment is used, only right hand lead wheel sets can have both wheels bored simultaneously. If a left hand lead wheel set is to be handled, each pin hole must be bored in a separate operation.

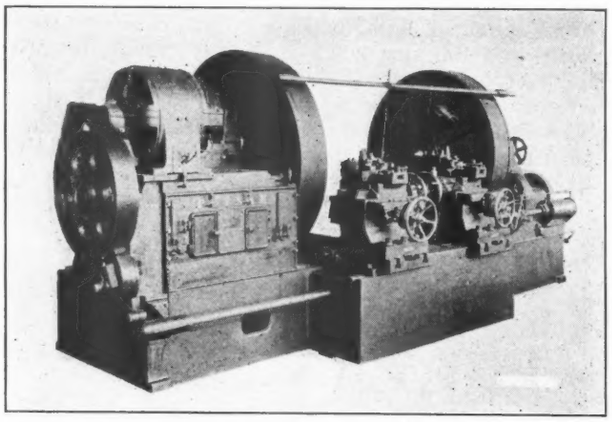
The tailstock quartering attachment is provided with an outboard support for the boring bar, whereas the headstock attachment carries the bar supported directly on the faceplate. Two adjustable clamps are provided to prevent rotation of wheel sets during the boring operation.

The main compound rest for turning the journals on inside crank axles of three-cylinder locomotives is made with a gap to allow for the swing of the inside crank.

The tool slides and rests are made to operate in the space of 15¼ in. between the wheels and the crank discs. A tool slide is used with provision for mounting a tool on either side; with one setting of the tool slightly more than a length of 7 in. may be turned and with the other setting of the tool the remainder of the 14 in. length of journal may be turned. The burnishing operation is accomplished in the same manner. The tool slides are provided with longitudinal as well as cross feed and also with a reverse for the feed. Either slide may be fed in either direction, longitudinally or crosswise, independently of the other tool slide.

This machine can be arranged for single or double crank pin turning. When the double crank pin turning attachment is used, only right hand lead wheel sets can have both pins turned simultaneously. If a left hand wheel set is to be handled, each pin must be turned in a separate operation. Two tools are mounted on one end of the sleeve, the other end being clamped to the quartering spindle. The pin turning sleeves surround the crank pins, thus providing a rigid support for the tools. The tools are mounted in two adjustable plates for the setting for various size pins. Each tool is independently adjusted by a screw to obtain fine adjustment. When the pin turning attachments are not in use they are removed from the machine.

For the main drive a 3 to 1, adjustable speed, 15-hp., 500 to 1,500 r.p.m., shunt-wound direct current motor is recommended. A shaft extension on the commutator end is required for mounting a solenoid brake. The control should include dynamic braking and the necessary special resistance to make the time required for the motor to come to a stop, or to come up to speed on starting, four times as long as standard. This feature is required to prevent undue shock when starting or stopping the heavy faceplate and wheel set. The function of the solenoid brake is not to stop the machine, this being accomplished by the dynamic braking, but to hold the faceplate from revolving in its unbalanced condition, after it has been brought to a stop. The main drive motor and solenoid brake are mounted on a bracket on the rear of the headstock, the motor being geared directly to the driving worm shaft. Two constant speed 5-hp., 1,000 r.p.m., tailstock traverse, direct current motors

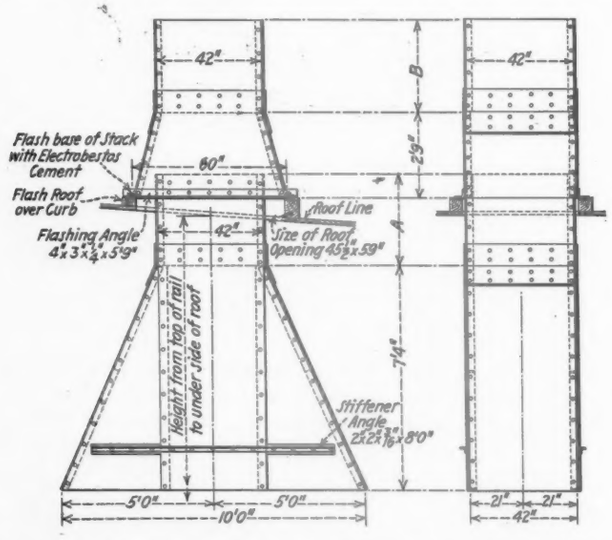


Putnam 90-in. journal turning lathe arranged for head and tail crank pin turning

with reversing control are recommended for traversing the headstock and tailstock. The traverse motors are mounted inside the bed, one at each end and the power is transmitted through friction clutches to the traversing screws. The clutch operating levers are mounted in front of the double carriage base in a position convenient for the operator.

Transite asbestos wood smoke jack

THE Johns-Manville Corporation, 292 Madison avenue, New York, has recently placed on the market a Transite asbestos wood smoke jack designated as the Type AV. The radical departure from previous designs of square jacks is that it provides ventilation at the roof line without sacrificing economy of construction and ease of assembly. The portion of the smoke jack within the enginehouse is identical with previous designs in that it is composed entirely of flat sheets of Transite asbestos wood.



A Johns-Manville smoke jack designed to provide ventilation at the roof line

At the roof line, the opening through the roof is enlarged on two ends and a special ventilating section is placed over this opening, which provides a means for smoke and gases to enter the stack at the roof line. This opening is approximately 9 in. wide and of a length equal to the width of the stack. The portion of the stack inside the house telescopes the ventilating section to prevent any possibility of the side draft forcing the fumes back into the engine house. The ventilating section is so designed that the height of the stack above the roof may be varied to suit local requirements, as the top of the ventilating section accommodates a standard 42-in. square stack.

The smoke jack acts on the principle of a venturimeter. The blast of the locomotive passing through the stack creates a suction which assists in expelling the smoke fumes which may collect at the roof line.

The erection of the jack has been greatly simplified. The portion of the jack inside the house is erected inside the house and hoisted into place; the portion of the jack above the roof line is assembled on the roof directly over the roof opening and when both sections have been assembled they are rigidly bolted together at the point where they telescope.

This advantage is particularly important with large jacks as the assembly and erection can be carried on as two separate operations, thus eliminating the necessity of handling the bulky equipment as a complete unit. In practically all cases it is necessary to support the hood inside of the house by hanger irons, or by a cradle of some kind, and by having the jack in two distinct units the hanger irons support only that portion of the jack which is inside the enginehouse, thereby relieving them of considerable strain.

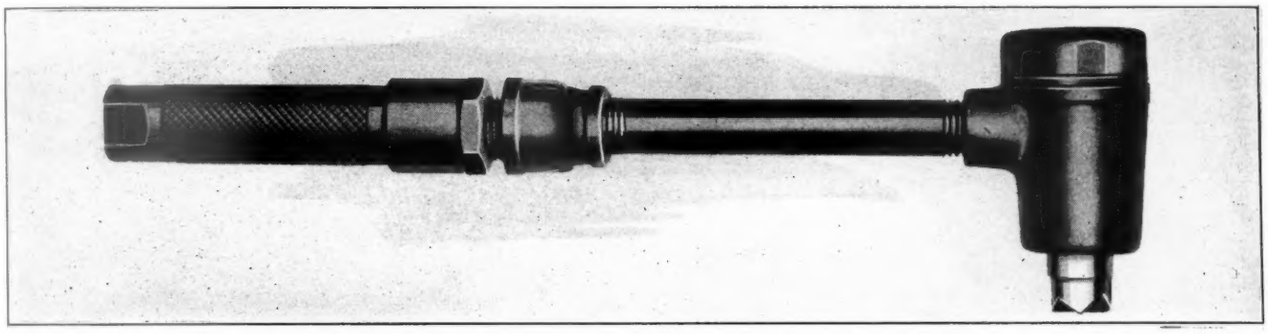
All parts of the jack are drilled from jigs and the spacing of the bolt holes is so located that similar parts of the same jack are reversible and interchangeable with similar parts of other jacks. This feature prevents any confusion in assembly and facilitates the replacement of any parts which may be accidentally damaged or broken.

Pneumatic scaling tool

A PNEUMATIC scaling tool has been developed by the Ingersoll-Rand Company, 11 Broadway, New York, for use in cleaning rust and scale from boilers and tanks. It is particularly effective in close quarters or around rivet heads. It consists of only four parts.

The piston projects from the lower end of the barrel and is finished at this end with hardened teeth. In operation, the piston vibrates back and forth in the barrel at a very high speed. The teeth which are held on the work thus, deliver a succession of sharp, quick blows which cut and knock off any rust, scale or old paint from the side of a boiler or tank.

Two lengths of pistons are furnished. One projects 7/8-in. from the barrel and has a working face 7/8-in. in diameter. This style piston is supplied in the Size 16 hammer and is used on flat work and around cone head rivets not over 1 in. in diameter. The other piston projects 2 1/8 in. from the barrel and has a 5/8-in. working face. This is used around cone head rivets larger than 1 in. The weight with the throttle, as shown in the illustration, is 4 3/4 lb.

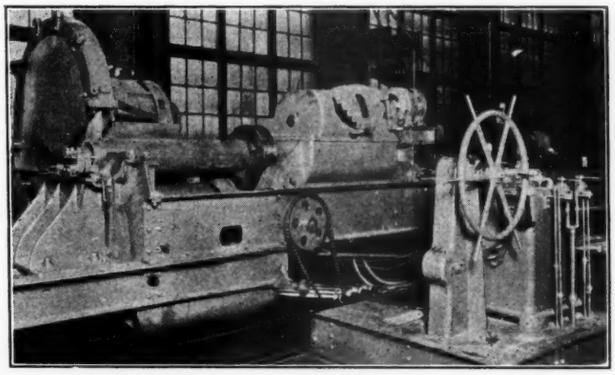


Ingersoll-Rand pneumatic scaling tool for cleaning rust and scale from boilers and tanks

Rotary attachment for friction saws

A ROTATING attachment has been developed by Joseph T. Ryerson & Son, Inc., Sixteenth and Rockwell streets, Chicago, for use with either the No. 3 or No. 4 Ryerson high speed friction saws so that large rounds, pipe, squares, etc., can be cut to the shortest lengths with a minimum of time. The attachment consists of a structural framework upon which a carriage for the material travels. A pneumatically operated chuck grips one end of the stock. It is rotated by a constant speed motor through a change speed gear box all located on the carriage. Power lines, for the motor, are located in a protected position on the frame. A center rest mounted on the worktable of the saw is arranged to receive bushings for the various sizes of material. A sliding gage stop, also located on the worktable, consists of a heavy casting with a screw stop providing for fine adjustment. Between the steady rest and gage stop is a vee-shaped support which holds the work while it is being cut and acts as a dumping device for the finished pieces. It is connected to a pneumatic cylinder and operates from the control stand.

The one central control stand, located at the right front of the saw, enables one operator to control all operations from the one position. Levers controlling the saw, cooling water for the saw blade, air valves for operating the pneumatic chuck, together with a capstan wheel for moving the material forward to the next cut, are all located on the stand. Controls for starting the motors can also be placed on the stand if desired.



Rotary attachment permits cutting large round and square stock on a friction saw

Pressure-feed paint container

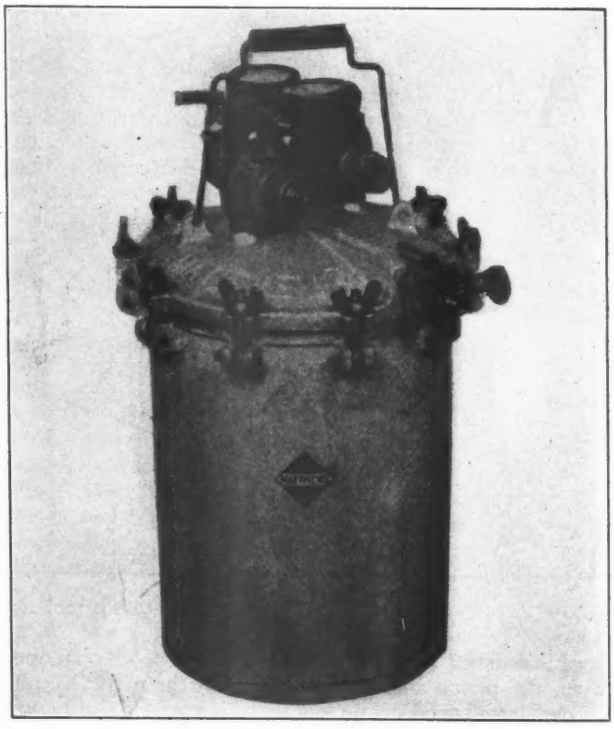
THE illustration shows a five-gallon pressure material container manufactured by W. N. Matthews Corporation, St. Louis, Mo., which can be used for mechanical painting. The paint pot or bucket can be set inside of the aluminum container from which the paint can be used directly. The regulator, reducing valve and pressure gages, together with the safety valve, pressure release cock and the volume control valve are mounted on the cover. Specially designed traps located below the reducing valve prevent the paint from getting into the air reducing apparatus.

The cover is fastened down by a circle of quick acting, shackle type wing bolts, which do not require wrenches, but can be securely fastened by hand. The container can be filled without removing the top. It is equipped with a new device (for which patent application has been made) which simplifies the adjustment of the volume or amount of material fed to the gun. This device is designated as the Matthews volume control valve. When it is desired to operate this valve, the knurled handle is pushed into the bushing until the graduation marked No. 1 on the indicating rod stops on the right side of a boss through which it passes. At this position, the smallest opening in the valve is exactly in the center of the material container cock and the least amount of material will issue from the gun. If this is not enough material, the volume control valve stem is pushed up to the next graduation, marked No. 2. This will allow more material to issue through to the gun. If this is not enough, the handle is pushed through to the graduation which will give the desired flow of material.

When it is desired to clean the gun, the control valve is pushed to the graduation marked *C*. It is sometimes necessary to push it through to the graduation marked *C* when it is desired to obtain considerably more material than will issue through the No. 4 orifice or when the paint is unusually heavy. The air pressure on the material in the container is not variable. The control valve is not intended to be used entirely to cut off the supply of material; when this is necessary, the regular lever handle is used for this purpose.

To clean the conical passages in the volume control valve, the cotter key in the graduated stem is removed and the stem pulled out of the valve. It is essential to turn the main handle on the valve at right angles with the small line so that the material will be shut off before removing the control valve stem.

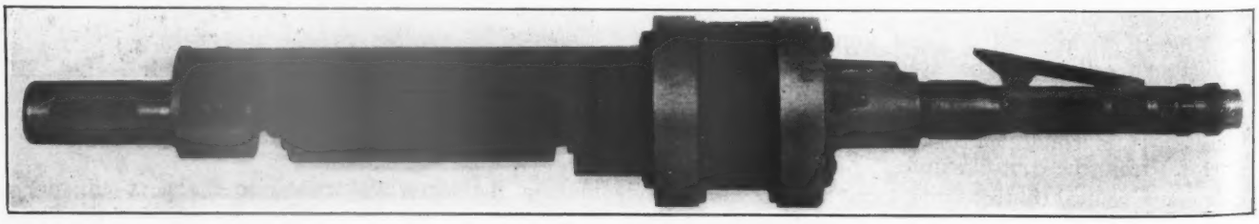
The spray gun used with the equipment applies all surface coating materials from the finest lacquers to Navy specification red lead, weighing 25 lb. to the gallon. This gun produces an extremely fine atomization, applying a smooth, uniform, wet coat, eliminating "orange peel," "overlaps" and "spray waves." This same type of gun is also made for use with a jar, to be used in refinishing shops where colors or materials have to be changed frequently. These containers can be equipped with either hand or air agitators should this be desired. The containers are made in five and ten-gallon capacity and permit a one, two or three-gallon paint pot or bucket to be set inside them and the paint used direct without wetting the inside of the container.



The Matthews five-gallon pressure feed container for paint spraying

Hercules portable pedestal jaw grinder

A PORTABLE grinder has been placed on the market by the Buckeye Portable Tool Company, 135 Wayne avenue, Dayton, Ohio, for grinding pedestal jaws, links, side rods or any surface work of a similar nature. This grinder is of the portable air-driven type and embodies the same features as the tools manufactured by this company. It has only five revolving parts, eliminating the pistons, toggles, connecting rods, etc. The tool is quickly and easily disassembled. It has ample power and speed to drive a 2½-in. by 6-in. by ¾-



Portable grinder for pedestal jaws, links and side rods

in. emery wheel. This wheel operates under a steel guard, which connects the power unit with the handle on the outer end of the tool.

Another feature now incorporated in all Hercules tools is an air strainer which consists of two pieces screwed together which holds a double screen. It is effective in removing foreign matter from the compressed air and can easily be taken apart for cleaning.

Milburn paint spraying unit

THE Alexander Milburn Company, 1428 West Baltimore street, Baltimore, Md., has recently placed on the market the paint spray equipment illustrated, known as the Milburn Type E2 pressure feed outfit. This is recommended as a desirable unit for supplying the paint to the gun where it must be turned at different angles or for painting large work such as freight cars, tanks, etc. The air pressure maintained in the paint container feeds the paint to the gun in ample volume required for this particular class of work.

The pressure tank has an inner receptacle which is easily removable and facilitates quickly changing of colors, as well as cleaning. A receptacle can be kept on hand for each color. The tank is constructed of steel, welded and has an air-tight cover. The unit consists of Type E gun, five-gallon pressure tank and inner paint receptacle, regulators for the air and paint pressure which are mounted on the tank head, 25 ft. of air hose, 25 ft. of paint hose with connections. Ten-gallon or larger tanks can also be furnished complete with regulators, safety relief valve and necessary fixtures.

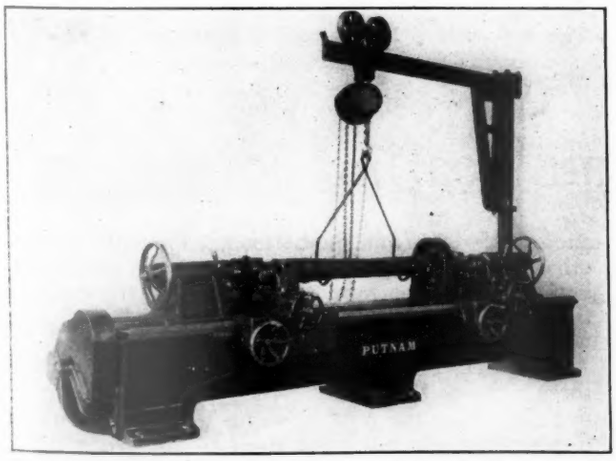
The Milburn Type E gun may be used for siphon-feed, gravity-feed or pressure-feed. The multiple head permits either a flat, horizontal, vertical or round paint spray. The round spray is so finely adjusted that it can be used for touching-up, shading or high-lighting.

The unit is compact and ruggedly built to withstand constant service. Its wide range of usefulness makes it a valuable asset to every paint department.

Paint spraying unit suitable for the car shop

Putnam car axle burnishing lathe

THE redesigned car axle burnishing lathe manufactured by Manning, Maxwell & Moore, Inc., New York, in general consists of two tailstocks and two carriages mounted on a substantial bed, each carriage having a front and rear burnishing tool. Both journals of an axle are burnished at the same time. The burnishing rollers are self-feeding and only one burnishing speed is supplied. Both tailstocks are adjustable along the bed. Permanent alinement is obtained by taper gibs.



Putnam journal burnishing lathe with self-feeding rolls

The carriages are guided by large vees on the front and rear of the bed. An additional flat bearing is located under the front burnishing tool which reduces the span of the carriage bridge. Gibs are located under the rear outside edge and under the front inside edge of the bed. The sliding surfaces of the bed are protected from dust and dirt by wipers attached to the carriages.

The two burnishing rolls, one at the front, and one at the rear, are brought into contact with the axle by a large diameter screw operating in bronze nuts. The screw is not confined in the carriage endwise, but is free to float, thus the burnishing tools are forced against the axle with equal pressure and no end thrust is taken by the screw or carriage.

By setting the burnishing rolls at a slight angle, they automatically feed themselves along the bed and stop when they strike the shoulder on the axle, thus no feed mechanism of any kind is required. Burnishing rolls are

mounted on large diameter studs which have large bronze bushed bearings on each side of the rolls.

The aprons contain only a pair of gears and rack pinion for hand movement of the carriages. The drive consists of only three pairs of gears, including the motor pinion and the gear on the axle. Only one work speed is required, consequently a constant speed motor is used without any speed change box. A quick acting three-jaw, self-centering chuck is furnished, which is readily placed in position on the wheel seat of the axle before the axle is mounted on the centers. A gear is mounted on the chuck which meshes with a gear on the main drive shaft of the machine in the bed.

When desired, a crane with a quick acting hoist is attached to the end of the bed for lifting the axles in and out of the lathe. The use of ball and roller bearings make it easy to operate.

A 5-hp. motor, 1,150 r.p.m., without pulley or slide rails, with either manual or automatic control is recommended.

The machine is furnished with chucking equipment for all axles from 3¾ in. by 7 in. to 6½ in. by 12 in.

Buffalo No. 0 universal iron worker

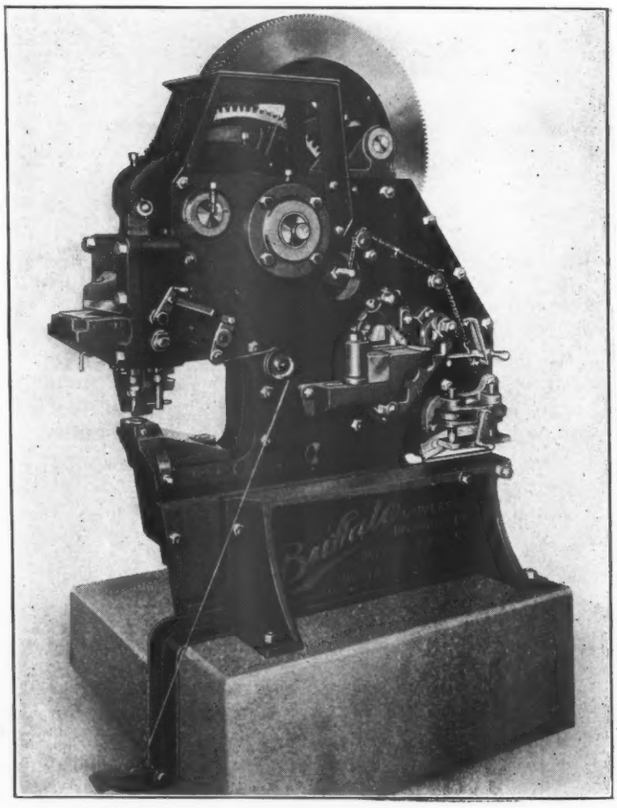
TO extend the field of usefulness of the Universal iron worker and make it available for a greater number of fabricating uses, the Buffalo Forge Company, Buffalo, N. Y., has brought out a new No. 0 universal iron worker—punch, shear and bar cutter combined. The No. 0 is in principle a smaller size of the present No. ½ and 1½ Universal iron workers, with such simplifications as the smaller capacity makes possible. The speed of operation has been increased to 35 strokes per min.

Special features of this machine include an armor-plate special rolled-steel frame; crucible steel shear blades with four interchangeable cutting edges; five-piece bar cutter knives to make sharpening and replacement easy, and triple punching attachment. It can be furnished with notcher for angles, I-beams, tees, channels, zees, plates and flats and other rolled shapes, without interfering with the regular punch, shear and bar cutter, if desired.

The guaranteed capacities based on soft steel are 65,000 lb. tensile strength and 15-20 points carbon. The machine will punch ⅝ in. by ½ in. or ¾ in. by ⅝ in. channels or I-beams in flanges 3 in. to 8 in., and in webs 3 in. to 10 in. It will shear ⅜-in. plates and 4 in. by ½ in., and trim one leg of angles up to 2½ in. The bar cutter cuts round bars up to 1¼ in., squares up to 1⅛ in., angles (square) up to 3 in. by 5/16 in., angles (miter) up to 2 in. by ¼ in., tees 2½ in. by ¼ in.; with special knives, beams and channels 4 in., 6.5 lb., or channels only 5 in. 6.5 lb.

With special tools this machine will cope I-beams square 3 in. to 6 in., channels square 3 in. to 5 in., angles square 3 in. by 5/16 in.; two cuts ½ in. wide for full depth; will notch 90 deg. angles 2 in. by ¼ in.

The weight of the small size universal iron worker, with pulley drive, is 2,200 lb., and with motor drive, 2,300 lb. The height of stroke is ⅞ in. and the depth of throat is 10 in.



The Buffalo No. O machine is designed for use as a punch, shear and bar cutter combined

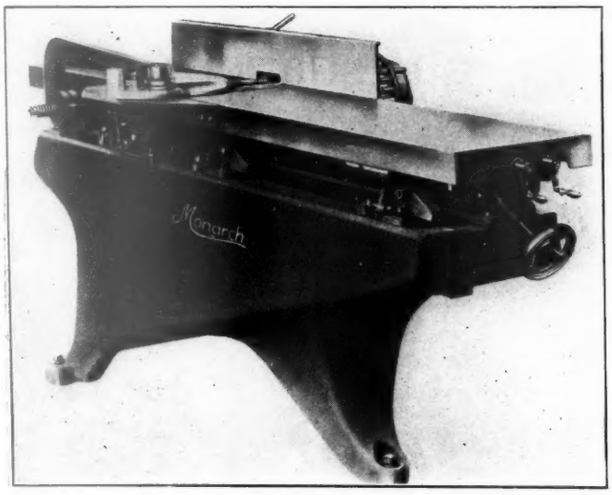
Monarch 12-in. ball bearing jointer

THE American Saw Mill Machinery Company, Hackettstown, N. J., has placed on the market a 12-in. ball bearing jointer designed with a three-point floor contact which insures against rocking and with a tilting table and a guard that meets the requirements of safety regulations. The frame is cast in one piece with wide-spread feet at the feeding-out end and one central leg at the feeding-in end, to give ample foot room for the operator.

The feeding-in table is 48 in. long and the feeding-out table is 36 in. long. The former may be tilted to an angle of 5 deg. from the horizontal for pattern draft or other taper work. The table is tilted and returned to a horizontal position by a crank shown at the end of the table. The tables are fitted with steel lips, but, if desired, will be furnished plain.

The safety guard is unique in design and is marked by three principal features. When in its operating position, it covers the head close up to the work which is passing through, adjusting itself to any width. It can be held open by a latch when its use is not desired. The guard can be thrown over entirely out of the way for

rabbetting without removing from the machine and when brought back into position it is ready for instant service. A coil compensating spring neutralizes its weight when the guard is thrown over into working position.



A 12-in. ball bearing jointer equipped with a unique design of safety guard

The fence is actuated by a cut rack and pinion and, when in position, is clamped fast. The fence has an adjustment for alinement with the rabbetting edge of the table. It tilts at any angle up to 45 deg. from the vertical with positive stops for these positions. The fence has a parallel traverse across the table.

The head is mounted in a heavy yoke which is doweled and bolted direct to the bed and cannot move out of line. It is 5 in. in diameter made of solid forged steel, and fitted with three high-speed knives. Provision is made for knife adjustment and for excluding all dust from the bearings.

For connection to an exhaust system, a cast iron hood or chute is fastened to the under side of the yoke inside of the base, to which an exhaust pipe may be connected. For individual exhaust, a specially designed fan is placed inside of the frame and is driven by a small belt from the head shaft to the fan pulley just outside of the frame, an opening being left in the frame for the pulley shaft to pass through.

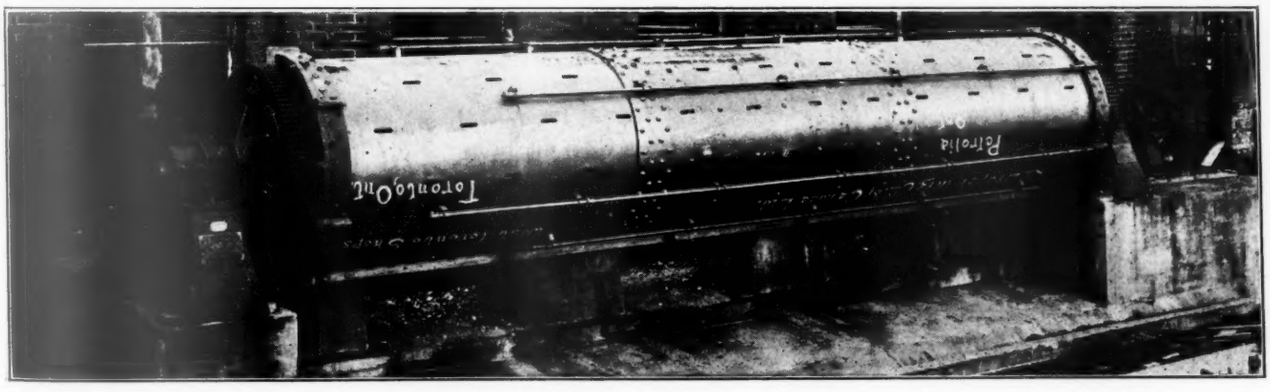
The principal dimensions are as follows: Extreme length, 89 in.; width of in-feeding table, 15¼ in.; width of out-feeding table, 13¼ in.; extreme width over the motor and rabbetting arm, 38 in.; depth of rabbetting groove, ⅝ in.; weight, 1,600 lb.

Redesigned Draper flue cleaner

THE illustration shows a redesigned flue cleaner manufactured by the Draper Manufacturing Company, Port Huron, Mich., and sold by the Scully Steel & Iron Company, Twenty-fourth Street and Ashland avenue, Chicago. The cleaner is mounted on a heavy, suitably arranged concrete foundation with curbed sides which form a well that is connected with a sewer or other outlet. The overflow of the cleanest water from the top of the well passes into an auxiliary well. This water, by means of a circulating pump, is used over and over through the flue cleaner. In cold weather the water can be heated in the auxiliary well by a pipe coil. A power pump with ball valves can be connected with one of the main shafts.

All the bearings of the shaft, motor and gearing are securely bolted to heavy iron foundation plates, and these, in turn, are bolted to the concrete foundation, thus holding all the shafts and gear in rigid alinement. All the gears are cut and the small gears are made of steel. The main drum bearings and the main shaft bearings are securely bolted to the same foundation plate.

The main drum with the reinforced double plate in the center is securely riveted to the end plates. The heavy drumheads overlap the ends of the steel drum, to which they are securely double riveted. The water is forced in through a hollow shaft at one end and through the cored drum head and a series of pipes and then distributed by 30 nozzles over the entire length of the cleaner. The water supply pipe is connected by a revolving connection. Oblong holes, 4 in. by 4 in., are cut in the steel drum through which the dirty water and mud drains to the settling tanks. The distributing pipes are securely fastened to the body of the drum and revolve with it.



Draper flue cleaner designed for a minimum consumption of water

Under some scale conditions, flues may clean better when rumbled dry and in this case all that is necessary is to shut off the water supply, thus having all the advantages of a dry cleaner.

The sides of the drum door fit into a bevel in the steel

drum and are held securely in place by forged bolts. The flues are loaded with slings or other loading devices through the door at the top of the drum. For unloading, the open door space, when turned to the bottom, allows the cleaned flues to roll out into a rack located near the cutting-off machine.

Morton railroad draw-cut shaper

A REDESIGNED, heavy-duty, draw-cut shaper especially adapted for railroad work has recently been placed on the market by the Morton Manufacturing Company, McKinney avenue and Hoyt street, Muskegon Heights, Mich. This shaper has a cutting stroke of 36 in., a horizontal feed of 36 in. and a vertical feed of 21 in., all of which are obtained automatically and

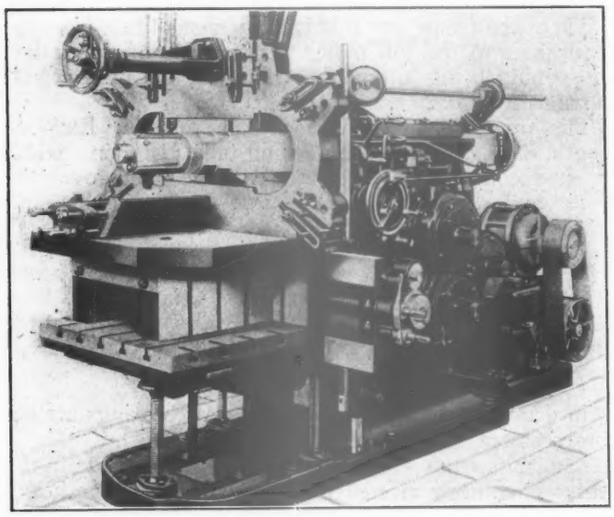


Fig. 1—Special heavy-duty railroad draw-cut shaper equipped with a re-designed double chuck

can be changed while the machine is in operation. The shaper is equipped for finishing railroad shop work on a production basis.

Driving boxes can be slotted and finished complete, and the machine can be equipped with a shell or crown brass

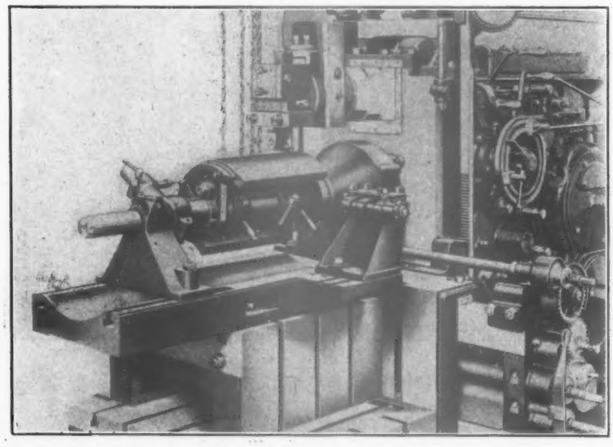


Fig. 2—The shell or crown-brass planing attachment

planing attachment, shoe and wedge attachment, rod-brass attachment and a special chuck for holding driving boxes while finishing the shoe and wedge fit. In Fig. 1, the shaper is shown provided with a redesigned double chuck which is used in slotting driving boxes. Adjustable stops and binders are employed to secure driving boxes of various sizes in the chuck. One of the advantages claimed for this device is the large saving of time effected in setting up work.

Fig. 2 shows the shaper equipped with the shell or

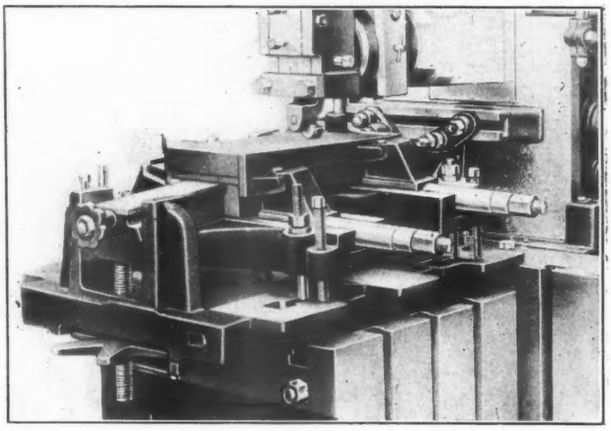


Fig. 3—Attachment for use in machining the face of shoes and wedges

crown brass planing attachment. The work is held rigidly, since the cutting strain comes against the rear head of the attachment and is transferred through backing screws to the face of the shaper column. Heavy cuts and coarse feeds may be taken. A hooking or shearing tool may be used for roughing, to increase the cutting efficiency by reducing the friction. Through the use of a slightly concave tool for finishing, a true surface may

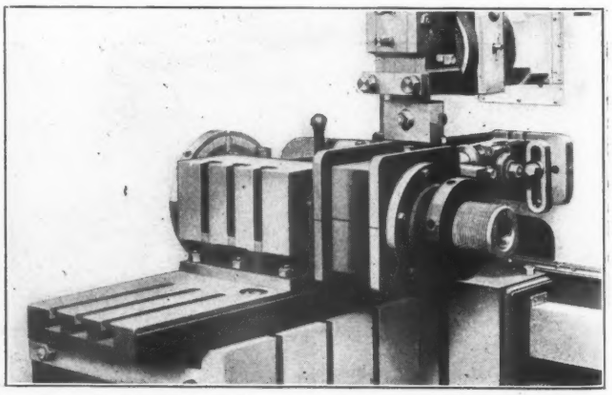


Fig. 4—Attachment for holding rod brasses while machining the strap fit

be obtained, with the lines cut in the same direction as those cut in the driving box. This method of machining insures a good bearing.

The shoe and wedge attachment is designed for finishing the face bearing of shoes and wedges after they have been laid out. As may be seen from Fig. 3, the construction of this attachment is such that it may be quickly adjusted to meet various angular requirements. The shoe and wedge are secured in the attachment before adjust-

ments are made, thus saving time often lost in shimming on these parts to obtain the desired accuracy.

The rod-brass attachment is designed to hold various sizes of connecting-rod brasses while machining the strap fit. This attachment is shown in place on the shaper in Fig. 4. With the chucking arrangement provided by the attachment, it is unnecessary to sweat the parts together before machining. Provision is made for setting the attachment at angles of 45 deg. to permit shaping off the corners of the brasses without extra machine set-ups.

The special chuck has been designed for holding driving boxes while machining the shoe and wedge fit. This chuck permits a quick set-up of the work and in conjunction with the stock-removing capacity of the shaper, enables the operation to be performed on a production basis. The dovetail angular slots are easily cut by shifting the bracket and the box on the table to the desired angle.

Two fire extinguishers for shop protection

THE illustrations show a two-gallon hand pump type and a ten-gallon Phomene foam type extinguisher manufactured by the Pyrene Manufacturing Company, 560 Belmont avenue, Newark, N. J. The two-gallon Pyrene hand pump extinguisher is designed especially to meet emergency conditions where it

The two-gallon Pyrene hand pump extinguisher primarily intended for electrical fires

is absolutely necessary to have a fire extinguisher of this capacity for fighting such fires as electric arcs, gasoline, kerosene, grease, varnish, etc. This extinguisher is made of two units, a powerful hand operated double-acting liquid pump and a container of two gallon liquid capacity. The pump is made of seamless drawn brass tubing and a cast brass pump head and handle. It is capable of ejecting a continuous stream from the nozzle of 3/32 in. bore for approximately 40 ft., which is a desirable feature for electrical fires.

The pump extends into the liquid container and is attached by a brass screw coupling and can be removed in a few seconds for filling or inspecting the container. The pump may be tested for operation at any time without a loss of liquid by inserting the nozzle into the screw opening provided in the pump head. A flexible metallic hose of 24 in. in length, covered with four-ply canvas rubber, enables the operator to direct the stream in any direction.

The container or liquid tank is made of pure copper sheet and is strongly seamed, riveted and soldered. The collar and base castings are made of a special quality brass. A hinged handle clip is provided for locking the handle which permits the extinguisher to be carried. The extinguishing liquid is non-freezing and being a non-conductor of electricity can safely be used on electrical fires without damage to the operator or the equipment which he is using.

The Phomene fire extinguisher is effective on all classes of fires including oil, gasoline, tar, grease, shellac, lacquers, inflammable solvents and chemicals. The extinguisher will, with 10 gallons of liquid, produce about 100 gallons of foam. The steel tank is a seamless drawn shell with the head riveted, sweated and soldered in place. The inside of the tank is coated with tin and lead.

The 10-gallon portable Phomene extinguisher produces approximately 100 gallons of foam

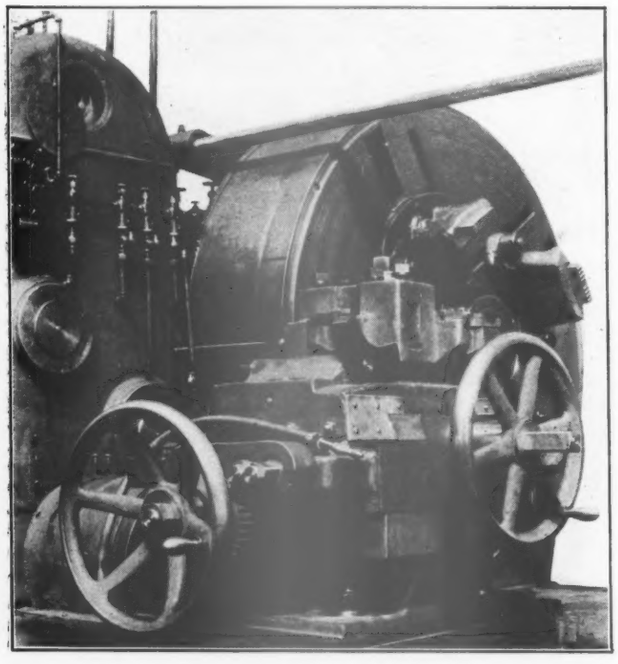
It is tested to 350 lb. The removable inner cylinder is made of cold rolled and annealed copper, tinned inside and out. The cylinder is sealed by a manually operated stopper. The extinguisher is provided with 8 ft. of ¾-in. chemical hose at the end of which is attached a brass shut-off type of nozzle 7¾ in. long with a ¼-in. discharge. The unit is mounted on two steel wheels, 16 in. in diameter. The outfit weighs 125 lb. empty, and 223 lb. charged.

Automatic driver dogs for car wheel lathe

THE turret tool post construction and full automatic driver dogs are two new features recently incorporated in the No. 4, 52-in. car wheel lathe built by the Niles Tool Works Company division of the Niles-Bement-Pond Company, Hamilton, Ohio.

The tool rest turret is provided with a cam locking device instead of the removable wedge as formerly used. All members of the tool rests are now of cast steel, with the exception of the lower base piece which is a 30 per cent steel mixture. All the slides of the upper members are lined top and bottom with hardened and ground steel wearing plates. The turret block is a steel casting to the underside of which is attached a hardened and ground steel plate. The upper surface of the longitudinal slide where the turret revolves is also lined with the same material which, combined with the hardened plate under the turret, forms an ideal revolving surface.

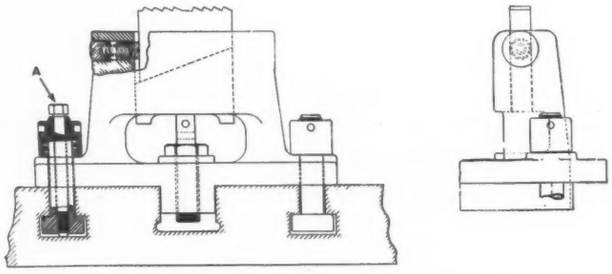
The central turret clamping bolt is now surrounded by a heavy spring and a ball thrust race so that when this bolt is released, most of the weight of the turret block is absorbed by the spring without actually raising the turret from its seat and, with the aid of the ball thrust, indexing can be accomplished with little effort. Each tool rest is equipped with an air hose nozzle to



The turret tool rest is provided with a cam locking device

clear away fine chips and dust accumulated during the turning operation.

The new driver dogs are fully automatic in action and have a simplified arrangement for setting radially for different diameter of wheels. There are four dogs on each faceplate. There are two taper blocks in each dog, the outer one having serrated teeth and the bottom one supported by a lock bolt. Normally, the pressure on the spring at the side forces the serrated block up the incline, but when the face of the wheels sets comes against the serrated edges, the dogs are forced down the incline, compressing the spring, until all the jaws are in contact. The wheels cannot possibly be distorted even though they are not true on the axle when forced against the dogs as sufficient clearance between the dog and the casting has been allowed to take care of any inaccuracy in the wheel rims. Tests recently conducted have shown that it is impossible to spring wheels even when two plates ⅛ in. thick, one for each wheel, were held diametrically opposite each other between the wheel and the dog. When the ma-



Construction of the automatic driver dog used on the Niles No. 4 car wheel lathe

chine is started, the serrated driver mounts the incline and each dog does its equal share of the drive. There is no other adjustment to make.

To adjust the dogs radially on the faceplate for different diameters of wheels, instead of loosening and tightening the two 1¼-in. bolts as before, all the operator has to do is to turn the small screw indicated at *A*, shown in the line drawing. The large nuts are set up on the bolts by a compression spring under the nuts as shown. The pressure of the spring is sufficient to take the weight and hold the dogs against the faceplate without slippage. To bind the dogs, it is necessary only to tighten the small screw one or two turns.

Another improvement, making for more rapid operation, is the speeding up of the traverse of the right hand head along the bed from 35 in. to 70 in. per minute.

To provide greater chucking range, each pair of axle journal split bushings is now provided to take care of journals from the standard size down to the A.R.A. wear limit without the use of liners. That is, the range of each set of bushings will accommodate journals varying by as much as ½ in. in diameter.

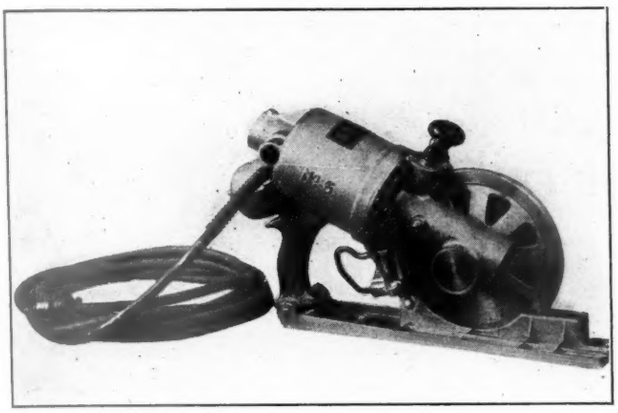
Other changes include an improved lubricating system for the right hand head whereby oil is forced from the main pump along side the left head, to the reservoir in the right head, through piping having a telescoping joint running along the channels of the air hoist. Formerly it was necessary to replenish this reservoir by hand.

Owing to the large swing of the lathe and the large main spindle diameters, it is regularly equipped to turn trailer wheels having a diameter of 11¾ in. over the journal collars. The journals are inserted inside the sliding spindles and the wheels mounted on pointed centers. In a special machine, recently built, provision has also been made whereby wheel sets having outside journals from the minimum up to 10½ in. in diameter can be chucked by using split bushings. This is effected by increasing the diameters of the main and sliding spindles. This feature is offered as optional equipment.

To take care of the increased weight of trailer wheel sets and heavy car wheel sets, the channels and the other members of the pneumatic air hoist have also been made of heavier sections.

Wallace electric handsaw

AN electric handsaw provided with safety devices to protect the saw blade, the motor, the switch and the operator, has been placed on the market by J. D. Wallace & Company, 134 South California avenue,



The Wallace electric handsaw is well protected against accidents

Chicago. The saw is operated by an air-cooled General Electric universal motor which is connected to the saw blade by a direct worm gear drive. The toggle motor switch is designed not to burn out under heavy load and is located so that the current will not be turned off and cause damage if the saw blade should stall in the work. The switch is protected by an aluminum cover as a protection against damage or accidentally turning on the current. The motor is provided with 20 ft. of No. 14 rubber covered, oil and acid proof cable, at the end of which is attached an adjustable separable, armored plug which fully protects the terminal connection.

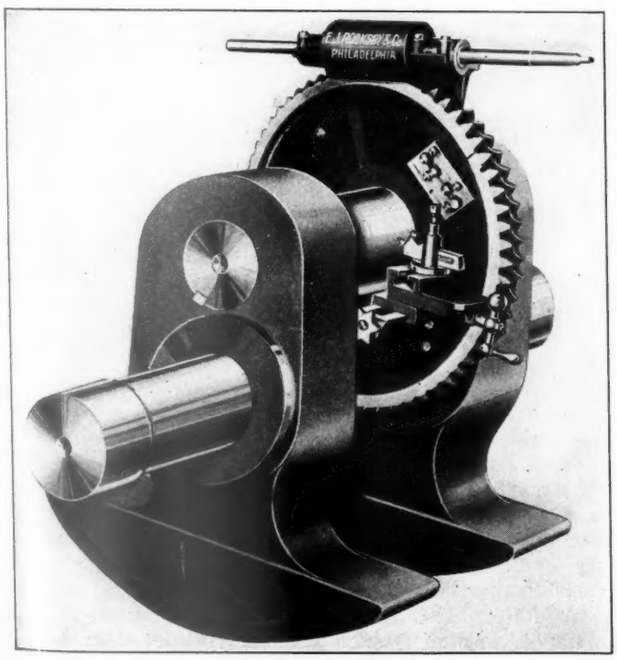
The trigger for releasing the safety shoe and lowering the saw on the work is located within the opening formed by the saw grip handle. The depth stop to regulate the depth of the saw cut controls the movement of the safety shoe trigger. This shoe snaps into position covering the blade the instant the saw is taken from the work. This feature permits the machine to set firm on the base while at work or idle.

Located at the front end of the safety shoe is an adjustable hairline guide which enables the operator easily to follow the cutting line. The edge of the shoe is also used as a guide. The splitter is located at the rear end of the safety shoe, directly back of the saw blade. A self-adjusting spring automatically drops the splitter into the saw cut.

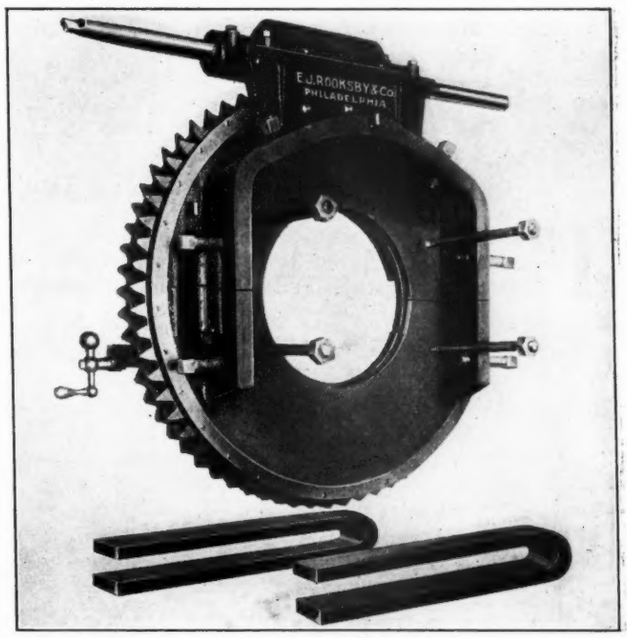
The machine is provided with an 8-in. saw blade with a 5/8-in. arbor hole. Rip, cross-cut, mitre or metal cutting saw blades, and a 3/8 in. dado head can be used in the saw. Owing to the fact that the casing and guards are made of aluminum castings, the machine, complete, weighs 23 lb.

Crank pin turning machine for third cylinder

THE advent of the three-cylinder locomotive has created a demand in the locomotive repair shop for a portable machine for truing up the center pins on the center crank axle. A machine has recently been developed for this purpose by E. J. Rooksby & Company, 1042 Ridge avenue, Philadelphia, Pa. The machine is composed of a stationary and revolving disc. The revolving disc is supported in the stationary disc by a keeper ring which provides a substantial journal bearing



The Rooksby crank pin turning machine set upon the crank axle of a three-cylinder locomotive



Rear view of the Rooksby crank pin turning machine

as well as a thrust bearing. The stationary disc is secured to the inside face of the crank cheek by adjusting screws and by studs and clamps.

The revolving disc is driven by a worm gear of a ratio suitable for either an air motor or electric motor and carries a substantial arm with a slide block and cross-slide to support the tool post and turning tool. The cross-side for setting to the correct diameter is similar to the slide block of a lathe. Both of the discs and the keeper ring are split in order to place the machine over the crank pin. The joints between the two halves of the discs are provided with a tongue and groove accurately machined and carefully fitted so that they may be readily assembled on the crank pin, at the same time keeping these parts of the machine in alinement.

As the machine is bolted to the finished inside cheek of the crank, it sets square with the pin. Provision is made for setting to the original center by a supporting cross-bar with a center and sleeve with a screw adjustment similar to the tailstock of a lathe. This centers the machine with the original turning of the pin.

The machine has a capacity to turn crank pins from 2 in. to 11½ in. in diameter and from 7½ in. to 9 in. in length.

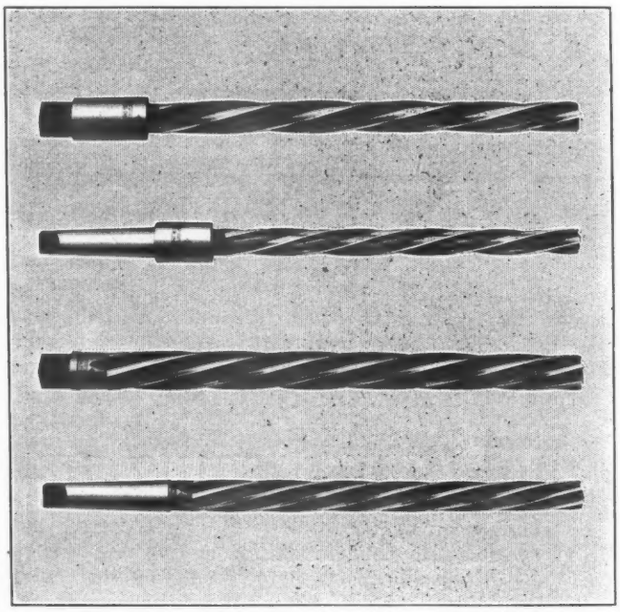
New reamers for railroad use

THE Cleveland Twist Drill Company, Cleveland, Ohio, has recently brought out new four and six-fluted taper locomotive reamers, certain sizes of which are made in accordance with standards adopted by the American Railway Tool Foremen's Association at its 1925 convention. The four-fluted reamers, Nos. 647 and 648 are made in square and taper shank, as are the six-fluted types, No. 651 and 652. All have a taper of 1/16 in. per foot of length and are made of high-speed steel.

In all four of the styles, the small end diameters range from ⅝ in. to 2 in., in variations of 1/32 in., while the flute lengths run from 8 in. to 26 in. The taper shank styles, Nos. 648 and 652 have No. 3 Morse taper shanks in the ⅝-in. to 31/32 in. dia. sizes; No. 4 shank in the 1 in. to 1 15/32 in. dia. and No. 5 shank in the 1½ in. to 2 in. sizes.

The four fluted reamers are milled after twisting in order to assure spiral accuracy, and to provide a correct flute shape for cutting and clearing the chips from the hole.

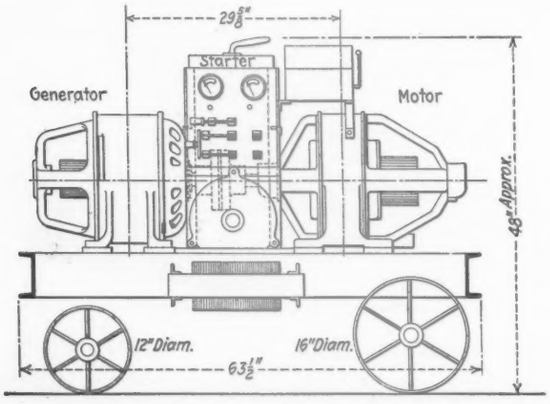
While both styles of reamers are manufactured in accordance with the Tool Foremen's Association standard, certain sizes and four intermediate lengths are provided in addition to the specified standards required in railroad shops.



The new Cleveland locomotive taper reamers—From top to bottom the styles are No. 647, No. 648, No. 651 and No. 652

Wilson electric single arc welder

THE single-arc, motor-driven electric welding machine manufactured by the Wilson Welder & Metals Company, Wilson building, Hoboken, N. J., is designed for both production and repair work in locomotive, car, boiler and tank and general machine shops. Its capacity is 25-400-amperes at 25 volts for metallic arc; 300 amperes at 35 volts for carbon arc, using electrodes up to ⅜ in. in diameter.



A single-arc motor-driven portable electric welder designed for both production and repair work

The generator is designed to give full load of 400 amperes when welding. The current will not rise over 10 per cent above that on a short circuit, thereby reducing the liability of the electrode sticking to the metal when striking the arc. The generator is self-excited and no ballast resistance of any kind is used under normal conditions. For amperages below 100, a shunt field booster resistance is used in the circuit. The commutator always shows less temperature rise than any other part of the machine. All regulation of current is accomplished by turning the field rheostat knob; no separate exciter or brush shifting is used. The arc is easy to strike and easy to maintain. This is accomplished by a properly proportioned reactance which automatically steadies the arc under all welding conditions.

A standard 15-hp., 40-deg. centigrade rise motor is furnished for any commercial voltage, phase or fre-

quency. For alternating current motors, the starter is the enclosed type, with magnetically operated push button and under-voltage and thermal overload protection. For direct d.c., it is enclosed with low voltage protection.

On the ebonite control panel is mounted a 500-ampere ammeter, 80-volt voltmeter, rheostat with a single knob, reverse polarity switch and a secondary switch for throwing the shunt field boster resistance in circuit when welding below 100 amperes. The rating of the generator is 250 amperes continuous on fixed resistance; 300 amperes for one hour on fixed resistance with 50 degrees temperature rise; 400 amperes continuous hand welding.

The machine is mounted on a welded steel frame constructed of 6-in. channel iron. Each machine is equipped with one plug, one receptacle, one electrode holder with 10 ft. of extra flexible, asbestos covered cable and 15 ft. of flexible, rubber covered cable attached; 25 ft. of flexible rubber covered, return cable and other accessories which are furnished with a welding machine.

The overall length of the machine is 54 in. with an alternating current motor and 64 in. with a direct current motor. The height over all is 44 in. and the width 26 in. with an alternating current motor and 30 in. with a direct current motor. The weight complete is 1,400 lb. with an alternating current motor and 1,540 lb. with a direct current motor. The front wheels measure 12 in. in diameter with a 4-in. face; the rear wheels measure 16 in. in diameter with a 4-in. face.

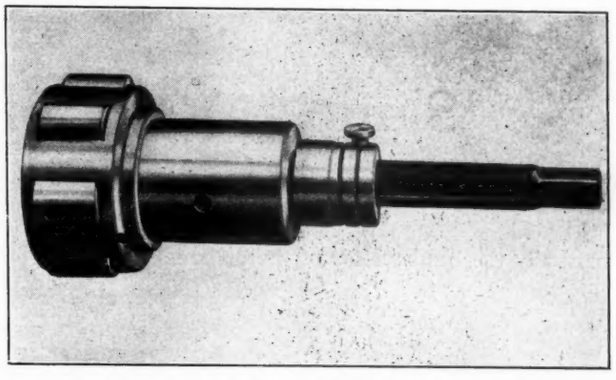
A method of applying rod bushings

IT is claimed that the usual method of pressing in main and side rod bushings and then boring to the size of the pin, leaves the brass soft and spongy. As a result, the metal is compressed after a short time of service, making the bushings oversize and pounding begins. The Faessler-Maupin process, developed by the J. Faessler Manufacturing Company, Moberly, Mo., is designed to produce an initial compression of the metal that cannot be increased by wear, which results in a more permanent bearing surface of accurate diameter in the bore.

How the rolling and expanding tool is used for inserting a bushing in a side rod

In this process the brass bushing is first turned to an easy driving fit, or loose enough to enter the hole by hand (driving fit preferred). The hole in the bushing is bored a trifle smaller than the pin diameter. For a 5-in. diameter pin, for example, the hole should be bored a little over 4 15/16 in. After inserting the bushing in the rod, the special Faessler-Maupin expander and roller used in the process is entered in one end to about one half of the depth of the rollers and the mandrel is turned to the right. The construction of the expander causes the mandrel to feed lengthwise, forcing the rollers outward until they bear against the inside surface of the bushing, when the mandrel will begin to turn hard. An adjusting stop on the mandrel is then set against a thrust ball bearing on the cage end, which locks the mandrel so that the rollers will maintain their diameter.

Continuing to turn the mandrel to the right, the tool travels lengthwise through the bore of the bushing, gradually expanding it. After withdrawing the tool, the diameter of the rollers is slightly increased and the operation is repeated for several passes until the brass has been rolled to the desired size or fit. The adjustment for size is graduated and measurements can be made to an accuracy of .0001 in. The finished hole is said to be absolutely true both circumferentially and longitudinally.



Expanding and rolling tool used in the process of applying side and main rod bushings

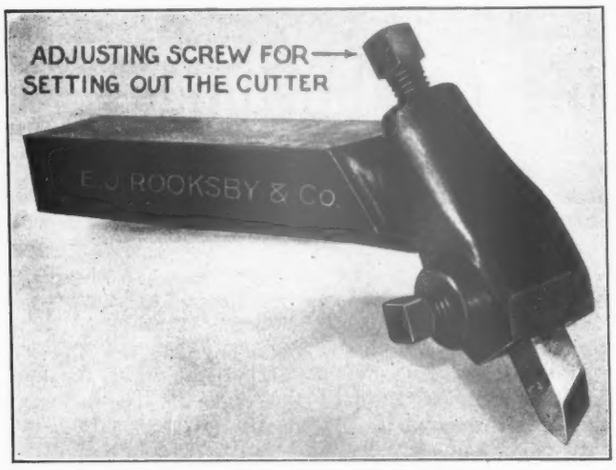
One of the advantages of this process is that a portion of the lubricant used in the rolling operation is forced into the pores of the metal as it is compressed. Tests have shown that even after the finished bushing has been washed and thoroughly dried, a slight heating effect, such as would occur in service, causes some of this impregnated lubricant to ooze out onto the surface thus, assisting greatly in improving the initial operation of the bushing.

The thoroughness with which the Faessler-Maupin process expands the bushing into the rod is indicated by the fact that it has required a pressure of 20 tons to start 5-in. bushings from the rod hole on attempting

to remove them. The special expanding and rolling tools used in this process are made in a full line of sizes for all bushings in valve motion and main and side rods, with a range of ¼-in. sizes of each tool. They are furnished in complete sets to take care of all size bearings for these parts.

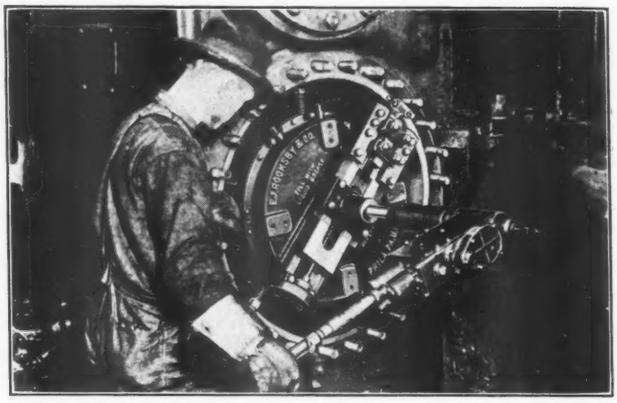
Redesigned portable facing machine

E. J. ROOKSBY & COMPANY, 1042 Ridge avenue, Philadelphia, Pa., has recently placed on the market a redesigned portable facing machine for refacing cylinder flanges, etc. The four pads shown in the illustration, each with two bolt holes, are for bolting four parallel strips to the machine to hold it parallel to the cylinder flange while setting up the machine.



The slide block and adjustable tool holder

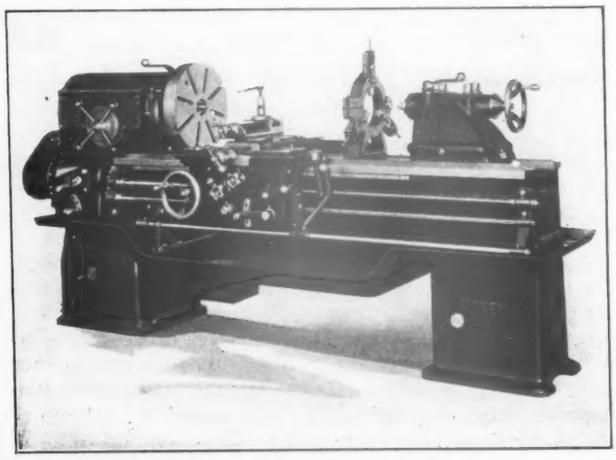
The reconstruction of the slide block and the addition of an adjustable tool holder are the two changes which have been made in the design. The slide block in the machine, as formerly made, had a tool bit in a square hole. The slide block, as illustrated, has clamps and studs to hold the tool holder. The set screw at the top of the tool holder sets out the cutting tool. A safety guard has been added to cover and protect the star wheel. These machines are made in five sizes to reface flanges from 18 in. to 45 in. in diameter.



Portable facing machine set up to reface a cylinder joint

Sidney Monotrol geared head lathe

THE Monotrol geared head lathe is the latest development of the Sidney Machine Tool Company, Sidney, Ohio, in a geared headstock lathe. Mechanically the headstock is of the progressive speed type with eight spindle speeds obtained by eight gear combinations, all of which are controlled by one lever on the front of the headstock. This lever operates three cylindrical cams which in turn engage the clutches, with the gears left in mesh at all times.



The Monotrol engine lathe is equipped with a progressive speed headstock having eight spindle speeds

All gears and clutches are of steel, heat treated, with the teeth cut and the bore ground after hardening. The analysis of this steel is SAE 1041 which has a tensile strength of 140,000 lb. per sq. in. The shafts are short and of high carbon steel mounted on SKF double roll ball bearings. The headstock spindle is 60-point carbon, turned and ground from a solid forging. The headstock bearings are of phosphor bronze, tapered in housings and straight on the spindle with outside adjustment collars. The moving parts of the headstock receive constant lubrication by a power driven pressure pump having a capacity of 50 gal. per hour.

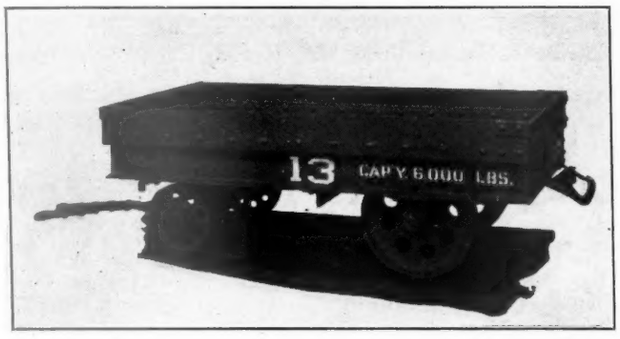
The lathe bed is fitted with heavy, double wall box type supports spaced two feet apart. The entire vees are cast with one-third steel mixture which gives a hardness test of about 42. The apron is of double wall box type construction with a large oil reservoir in the rear plate. All gears are made with steel and gear studs run in bronze bushed bearings. Proper automatic locking devices prevent the engagement of the lead screw and the feed rod at the same time. The carriage has an exceptionally long bearing on the vees and is scraped its entire length. The

carriage bridge width is designed for heavy duty and is fitted with heavy duty top block and compound rest. The tailstock is fitted with four clamping bolts. The quick change gear box is a complete unit of itself, tongued and grooved on the front end of the machine, and held securely in place with heavy bolts. The gear box provides a wide range of threads and feeds which are listed on the index plate mounted in connection with tumbler lever. All gears in the box are of high carbon steel.

Standard equipment includes the quick change gear box, large and small face plates, steady rest, thread chasing dial, mechanical apron control, hardened and ground lathe centers, and single pulley multiple disc driving clutch. A motor drive arrangement with the motor in a cabinet leg can be added if desired.

Gondola and dump body type trailers

THE gondola body and dump body types of trailers manufactured by the American Car & Foundry Company, 30 Church street, New York, are designed to withstand the heavy loads and rough usage encountered in the inter-department haulage systems of railroad shops and industrial plants in general.



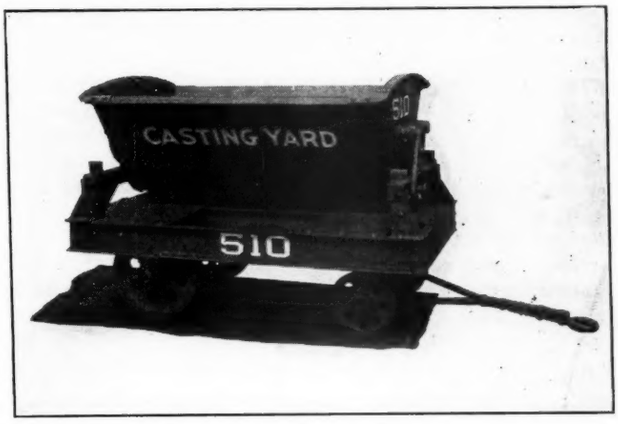
The gondola body type of trailer which has a capacity for 6,000 lb.

The frames are made of heavy channel and angle steel, hot riveted with the corners well gussetted. The bodies are made of heavy gage sheet steel reinforced with angles and bands. The cast iron wheels with self-contained roller bearings and Alemite pressure lubricating fittings are mounted on high carbon steel axles. The tread of the wheels is made with a slight crown to reduce tractive effort. The pressed steel caps are shrunk on the ends of the wheel hubs, making a close fit around the axles and thus keeping out dust and dirt.

All of the trailers are equipped with a rear drop forged gravity coupler hook for train operation. The coupling handle may be turned back under the trailer entirely out of the way, making it possible to use the trailers on short elevators and in narrow places.

The gondola body, which has a capacity for 6,000 lb., is adapted to the handling of miscellaneous loose material and crated or boxed material. It is equipped with removable corner posts and, if desired, can be equipped with a special bolster for handling long material, loading it on two trailers. The inside dimensions of the body are 6 ft. by 3 ft., by 6 in. high. Car weights 1,325 lbs.

The dump body, which has a capacity of 6,000 lb. or 24½ cu. ft., is designed for handling loose or bulky materials. The dump body is self-clearing and automatically locks itself in an upright position after returning from the dumping position. The inside dimensions of the body are 4 ft. 9⅜ in. by 3 ft., by 2 ft. high.



The dump body type of trailer which has a capacity for 24½ cu. ft. or 6,000 lb.

Lift truck employs new operating principle

THE Baker-Raulang Company, Cleveland, Ohio, has just developed what is designated as the Series D elevating trucks which employ a new lifting principle. The underside of the platform is fitted with four steel inclines which run against hardened steel rollers pinned to the truck underframe. During the elevating operation the platform is pulled up these four inclines by two roller chains. The platform travels a maximum of nine inches with a net lift of six inches. Two additional rollers operating against the top of the forward inclines, prevent the platform from tipping and insure its remaining parallel with the ground regardless of the distribution of the load.

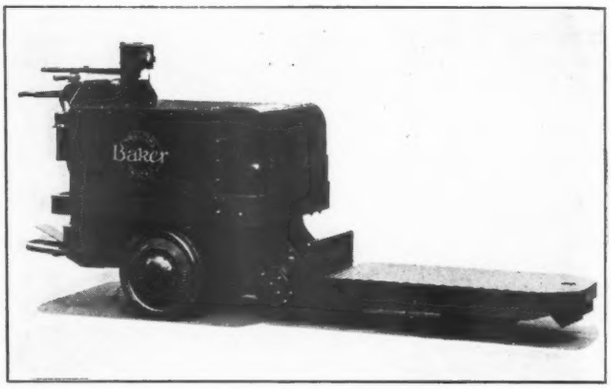
The lifting unit consists of an enclosed compound-wound motor operating through a triple spur gear reduction and a fourth reduction consisting of a double set of planetary gears working in parallel. This motor drives two hardened steel pinions which wind up the two lifting chains. The limit switch, operated by a rack and pinion, opens the hoist motor circuit at both limits of travel. An enclosed magnetic disc brake mounted on an extension of the armature shaft brings the motor promptly to rest after the limit switch operates. The control switch for the elevating motor is mounted on the dash where it is accessible. By manually operating this switch the hoist motor may be stopped at any point and started up again or reversed as desired. It is not necessary to go through the entire cycle of operations.

The frame is entirely fabricated from structural steel which provides the greatest tensile strength in proportion

to the weight. The balance of the parts on this truck are Baker inter-standardized units and are identical and interchangeable with similar parts on all other Baker models.

The driving axle consists of a Baker series type vehicle motor driving two 20-in. wheels through a worm wheel reduction and a four-pinion bevel gear differential. Drive shafts are chrome-vanadium steel, while the universal joints are 3½ per cent nickel steel forgings. The wheel bearings are Hess-Bright RC type radial ball-bearings which provide for both radial and thrust loads. The trailing axle consists of an alloy steel forging. Each wheel turns on an individual knuckle and is fitted with two Hess-Bright radial ball-bearings.

The controller has the standard Baker all metal drum with renewable segments; the fingers have both reversible and renewable tips. The automatic switch consists of a solid copper stationary contact and a laminated moving member which makes a wiping contact. Auxiliary carbon contacts are provided which make or break the circuit just ahead of the metal contact. This switch is interlocked with the controller and brake pedal so that it is impossible to operate the truck except with a conscious and sustained movement on the part of the operator. These trucks are built in several types.

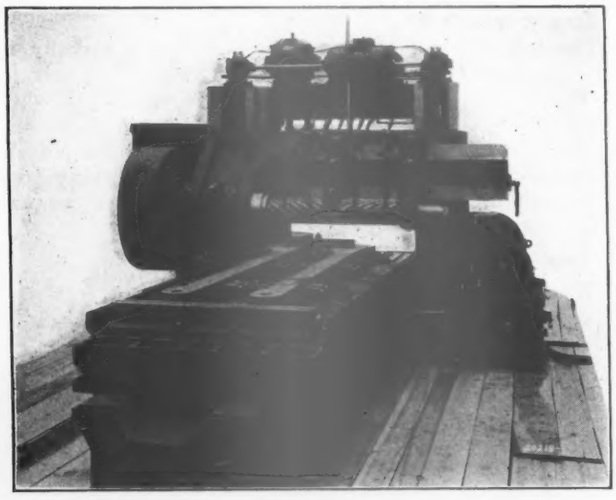


The Baker Raulang Series "D" elevating truck uses an incline to lift the load

Crossrail down-feed for rod miller

THE illustration shows a redesigned rod milling machine built by the Niles Tool Works Company division of the Niles-Bement-Pond Company, Hamilton, Ohio. This machine has a capacity of 58 in. between the housings and a table 54 in. wide by 16 ft. long accommodating six of the largest rods for edging or two for slabbing or channeling.

New features include a crossrail down-feed entirely independent of the table feed in amount and direction, allowing the operator to select the proper down-feed without consideration to the amount of longitudinal feed on the table, at the same time greatly increasing the feed range. This is a desirable feature for sinking the milling cutters into the work and for securing the proper radius on the rods.



The crossrail down-feed on the Bement rod milling machine is independent of the table feed

The crossrail is made in the form of an L-shaped casting and carries at the left end the cutter spindle and quill, also the large worm gear drive box. The cutters are driven by a 75-hp. motor mounted on a plate at the floor level to avoid vibration, and transmits its power to the cutter spindle through a large worm and worm wheel enclosed and running in constantly circulating oil. The crossrail is suspended by two heavy screws, having ball thrusts at the top and anchored at the bottom to prevent buckling by upward thrusts. It has a rapid vertical movement by power and a wide range of automatic vertical feeds, also a hand feed for fine adjustment by a ratchet lever at the operator's end of the crossrail. A scale is provided to enable the operator to set the rail to the correct height from the table. On the crossrail are two adjustable bearings, one to support the end of the mandrel, the other for an intermediate position. The adjustment for these bearings along the rail is by rack and ratchet.

Both the crossrail feed and the table feed are operated independently of the main driving motor, but the electric control equipment is so arranged that neither the table feed motor nor the crossrail feed motor will run unless the driving motor is in operation. That is, those motors are electrically interlocked so that failure of current to the driving motor, either accidental or otherwise, will disconnect both feed motors from the source of power. Means are provided, however, by which either or both of these motors may be thrown in momentarily for running the table by fast traverse or for elevating or lowering the crossrail without operating the driving motor. This is accomplished by snap-out spring push buttons.

The table feed and traverse mechanism is operated by a 10-hp. motor mounted on a gear box housing at the right. The feed and traverse gears are totally enclosed and run in oil. These gears connect with the main feed shaft under the table which transmits its power by a bronze spiral gear meshing with a steel rack bolted to the underside of the table. Provision is made in the feed box by which the table may be securely locked in position to allow channeling cutters to be fed down into the work without danger of table movement and consequent damage to the cutters and machine. The table feeds range up to 12 in. per minute and traverse up to 20 ft.

The crossrail feed and traverse are obtained from a 5-hp. motor on the crosstie driving through an oiltight gear box to the two elevating screws. Feeds up to 3 in. per minute and traverse up to 16 in. are available.

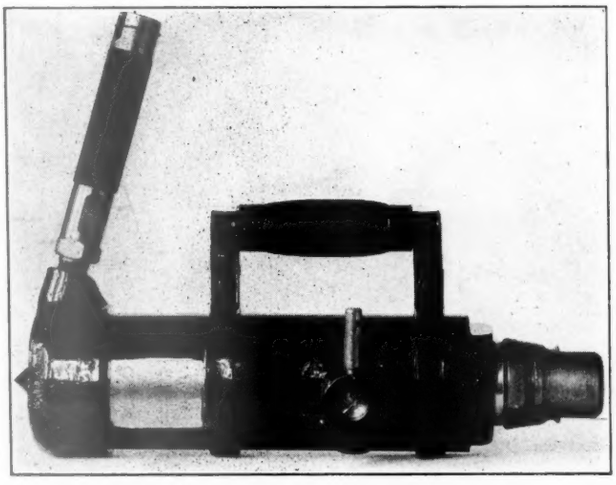
The cutting fluid attachment consists of a pump and piping which delivers the coolant from a tank in the machine base to the cutters through a series of flexible nozzles distributing the fluid to the most suitable points. Adequate drains in the table draw off the surplus coolant and return it to the main reservoir

Attention has been specially directed to insure ample lubrication to all moving parts of the machine, and a constant circulation is provided by two pumps, one driven by an extension of the main drive vertical worm shaft to secure a continuous flow to the worm and worm wheel; the other in the feed gear box on the right-hand housing which not only serves the feed box and table drive mechanism, but also pumps oil to the vertical feed box on the crosstie which also has a reservoir from which oil flows to the enclosed gear boxes at the upper extremity of each vertical crossrail screw. Separate lubricators are provided for the table ways. The table rack gear and rack have special flood lubrication.

The machines can be furnished complete with fixtures for slabbing and channeling as well as for edging. These are adjustable for various sizes of rods.

Thor hammer type holder-on

THE Thor hammer type holder-on manufactured by the Independent Pneumatic Tool Company, 600 West Jackson boulevard, Chicago, is particularly designed for driving rivets in tight places and corners where it is impossible to use a regular size riveter. It is also used as a holder-on to buck up rivets.



Thor hammer type holder-on designed for driving rivets in tight places

The hammer proper is the standard Thor long stroke riveter hammer. The head block over the valve has the Thor ratchet lock to the barrel. The holder-on barrel is made of a solid piece of steel with the rear cap threaded on. Into this cap is screwed a throttle which admits and releases the air to the rear end of the hammer. The front end of the holder-on barrel is solid with an internal groove for a U-shaped packing, which is self-adjusting. The poppet type choke valve has its seat in the wall of the holder-on barrel. The body of the valve fits loosely in the guide which is assurance that it will always hold tight but will not easily stick. It is opened and closed by a cam action through the handle and is provided with a tension plug and spring and a flattened surface on the body to hold it either positively open or closed. A return spring is provided so that the holder-on action will instantly release as soon as the throttle is closed. A side handle is securely clamped to the body of the holder-on in addition to the regular throttle.

A number of thin steel washers are placed between the holder-on barrel and the rear cap so that the position of the throttle can be easily changed by removing or adding to these washers. This tool is made in four sizes. The weight of the smallest size is 30 lb. The largest size weighs 35 lb. The lengths of the four sizes without the center or set are as follows: 12¾ in., 14¾ in., 16¾ in., and 17¾ in. The stroke in all sizes is 3¼ in.

Self-adjusting ratchet type wrench

THE Heller Brothers Company, Newark, N. J., has acquired the patent rights of a self-adjusting ratchet wrench that fits various size nuts. This tool, which is sold under the trade name of Masterench, is made from heat treated, drop-forged chrome-vanadium, steel. Each one of its three parts, after being forged and milled to size, is put through a die to assure uniformity.

It is so constructed that it will grip a smaller nut harder than a larger one. The wrench will take hold of every size nut within its range, regardless of whether it is hexagon or square. There is no play between the

An 8-in. size self-adjusting ratchet type wrench with smooth jaws for gripping nuts

jaws since the physical contact of the wrench increases with the load on the work and conforms itself to the shape of the nuts. The wrench can be used in a restricted place at an angle of 45 deg.

The claim is made that no man is strong enough to break the wrench without resorting to additional leverage. If additional leverage is used, the wrench will either strip the thread of the nut or either break or twist the bolt.

At present, the wrench is available only in the 8 in. and 10 in. sizes. However, larger as well as smaller sizes are in the process of manufacture. These can be had with the smooth jaw type for use on nuts and bolts and the pipe jaw type for use on pipe.

Combined crane and lift truck

THE Elwell-Parker Electric Company, Cleveland, Ohio, has recently placed on the market a design of electric truck provided with a boom crane to lift the load from the floor level to the level of the truck platform. This particular type is the natural outgrowth of the crane type truck and the low lift truck. The height and width limits are held within clearances such as will permit the trucks to enter a car or travel conveniently through crowded aisles. In operation this truck provides a piece of equipment with which the operator may perform the loading operations independent of another unit. The outstanding characteristics of this particular machine are the four-wheel steering arrangement, the low head room required for operation and the large volume capacity of the truck platform under the boom.

This tructor employs no fuses to safeguard the motor but the armature is wound to take the full ampere output of the battery. The manufacturer has found that it is common practice for an operator to insert a piece of copper wire for fuse wire when a heavy load is to be pulled and consequently a fuse is no protection. The motors being driven by direct current and being series wound, have a large overload capacity so that loads are taken up ramps with ease. This overload capacity, coupled with the independent brake and controller operation, allows full power to be applied to the driving wheels before releasing the brake, allowing the truck to start on grades without the usual sliding back.

In order to operate the truck it is necessary that the workman must be standing on the pedals in place and if the operator steps or falls from this position the power is automatically cut off and the brakes applied at once.

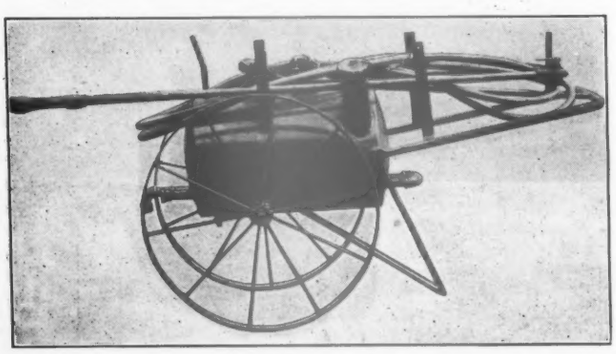
Other features are the all steel construction, enclosed motor and controller and separate lift and travel motors.

This new type of Elwell-Parker truck is provided with a crane to lift the load onto the truck platform

The lift motor is fitted with an electro-mechanical brake automatically operated when the power is applied or cut off. The up and down travel limits are mechanically controlled.

Vacuum locomotive fire kindler

THE Vacuum locomotive fire kindler manufactured by the Johnson Manufacturing Company, 961 East Hennepen avenue, Minneapolis, Minn., has no oil regulating valve to be adjusted in the cab. The oil choke on the tank requires adjustment only when the viscosity of the oil changes due to a difference in the oil or a great change in temperature. The absence of an oil valve insures complete draining of kindler and hose after each fire. This eliminates the danger of fuel oil congealing in the oil line when the kindler is not in use. This system is an insurance against failure of the kindler to work on heavy oil under extreme weather conditions.



The Johnston vacuum locomotive fire kindler

The steam coil is standard equipment with both the No. 38 and No. 39 kindlers. Heating of fuel oil results in finer atomization, more efficient combustion, and a minimum amount of smoke.

The kindler is equipped with a safety trigger control valve which closes automatically and stops the delivery of air and oil if the operator's hand is removed. This prevents an accidental discharge of oil. The deflector spreader used with this unit changes the round jet to a flat fan shaped spray which mixes quickly with the air. It also reduces the velocity of the mixture so that an intensely hot flame is maintained and driven directly down onto the coal.

The kindler is built in two sizes both of which have a tank capacity for 20 gal. of oil, require the same floor space of 27 in. by 61 in., and operates on compressed air

from 50 to 128 lb. per sq. in. The principal difference between the two is that size No. 38 is designed to operate on 28-30 deg. Baume gravity fuel oil or any lighter oil, while size No. 39 will operate on extra fuel oil of greater viscosity than the ordinary oil of 28-30 deg. Baume gravity. It will also handle the light oils satisfactorily.

Heat treating equipment for the tool room

AN electric lead or salt pot furnace is being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which is well adapted for heat treating operations, especially in tool rooms. This furnace, designated as Type J, is applicable on work requiring the whole or partial immersion of the piece in molten lead or salt, for hardening or tempering. If case hardening is desired, molten cyande can be used. The maximum temperature obtainable is 1,650 deg. F. The furnace consists of a cylindrical steel shell enclosing the heat insulation and the chamber which contains the heating elements and in which the vessel is placed. The heating elements are designed to distribute the heat evenly to all parts of the vessel which does away with all uneven strains and hot spots. The vessel being made of an alloy resistive to molten lead, salt or cyanide and not being subject to destructive flame action has a long life. A top plate and seal are provided to prevent the entrance of dirt or molten metal to the inside of the chamber. A hinged cover is supplied to reduce the heat losses. This furnace is made in four suitable sizes for tool room use, all being furnished with automatic control.

The Westinghouse type "J" furnace is adapted to work requiring the whole or partial immersion of the piece

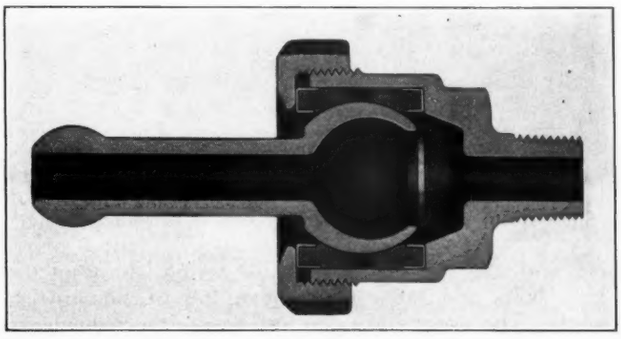
For drawing or tempering an electric oven has many advantages. The type K oven (not illustrated) manufactured by Westinghouse is especially arranged to give the exact and uniform temperature so essential. Heating elements are arranged on the side walls to create rapid circulation and, therefore, uniform temperature. Two sizes are available. They are shipped out completely assembled with automatic control. The automatic control feature on both the furnace and oven gives the desired flexibility for tool room use. By setting the control contacts to the scale point desired, the control will maintain the temperature indefinitely without attention from the operator. This assures duplicate performance and uniformity of results. The even heating of the tools reduces distortion to a minimum. This is particularly important where the tool being treated has a varying thickness.

Another important feature of the furnace is the small amount of heat radiated from it. This absence of excessive heat and fumes are especially appreciated by workmen during the hot summer months.

Pneumatic hose connection

THE type of metallic joint illustrated has been developed by the Barco Manufacturing Company, Chicago, for the purpose of increasing the serviceable life of shop air hose, which usually breaks off next to the pipe due to repeated bending at that point. The construction of this special Barco air hose connection joint is the same as the standard line of Barco joints, except for the ball on one end instead of the threaded pipe end. This ball is somewhat larger than the internal diameter of the standard air hose and in operation, the hose is pushed over the ball end and clamped in the usual manner. The bell end of the joint swivels approximately 30 deg. from the center line in any direction and the hose can therefore be swiveled that amount before introducing any bend in the hose itself. This tends to prevent abrupt change of direction of the hose at the end of the ball which, if frequently repeated, as is usually necessary in the average shop work, results in rupture of the hose.

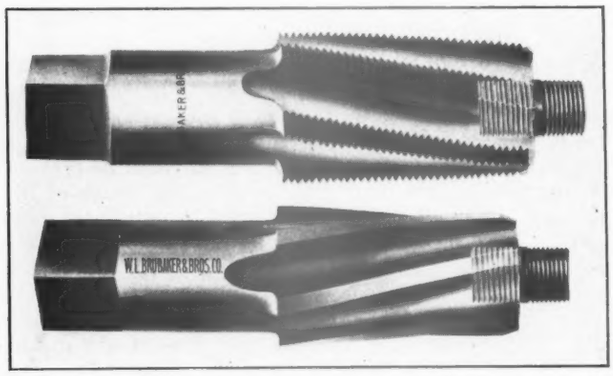
All parts of this air hose connection are interchangeable with the standard Barco joint parts such as may be found in railroad shops.



Barco pneumatic shop hose connection designed to increase the service life of air hose

Flexible staybolt tap and reamer

TO increase the service life of the flexible staybolt taps and reamers manufactured by W. L. Brubaker & Bros. Company, 50 Church street, New York, they are now made according to the design shown in the illustration. In place of making the pilot screw a solid part of the tool, these taps and reamers are made with a threaded (U. S. S.) hole in which is inserted an unhardened adaptor stud with its outer end threaded with a standard pipe thread for use with the usual extension.

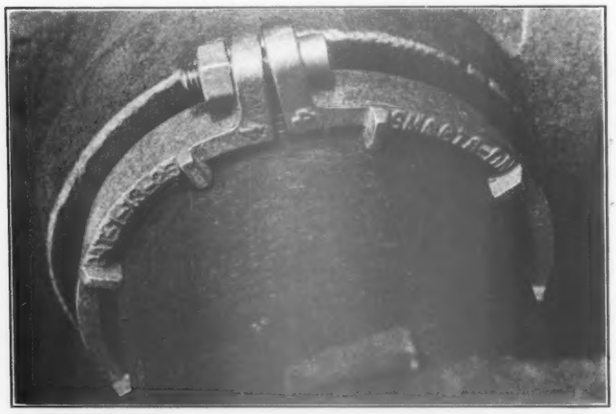


Brubaker flexible staybolt tap and reamer with removable pilot screws

The unhardened pilot screws are not brittle and consequently are less liable to break than those tempered with the tool. In case of breakage and stripping of the threads of the stud, the adaptor is quickly removed and a new one inserted, thus prolonging the usefulness of the tool. The same tools may be used with an extension having either an inside or outside thread.

Smooth-On pipe clamp

ONE method of stopping a leak from a threaded joint is to place a Smooth-On pipe clamp, developed by the Smooth-On Manufacturing Company, 570 Communipaw avenue, Jersey City, N. J., around the



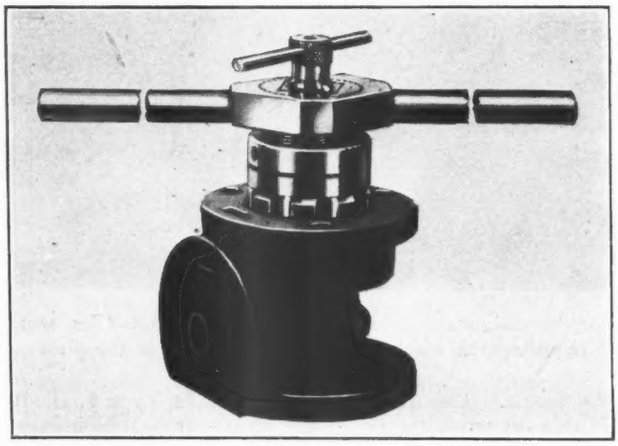
Smooth-On pipe clamp used against a threaded fitting

pipe, with the flat side against the fitting, draw up the clamp bolts and tamp the groove full of Smooth-On No. 1. The clamps are cast in halves for convenience in encircling the pipe, and are held together by set screws or bolts. Equidistant inner spacing lugs keep the clamp concentric with the pipe, making the recess for the cement uniform and easy to fill.

This combination may be used on any steam, water, oil, air or ammonia line and on iron, steel, brass or copper pipe. The Smooth-On quickly metallizes and in doing so expands tightly against and into the leak. The tightness is permanent under any temperature and pressure, because metallized Smooth-On has the same expansion co-efficient as the pipe-line metals. The clamp can be applied to threaded pipe fittings, valve ends, flange connections and inlets and outlets of any pressure container. The clamp strengthens any joint and when used at flanges, neither the clamp nor bolt heads interfere with each other.

Tool for reaming triple valve piston bushings

THE illustration shows a tool designed for reaming the worn bushings in triple valve bodies. The range of expansion is from slightly under 3½ in. to 3 9/16 in. The adjusting nut is graduated to read the amount of expansion in half thousandths. The reamer



An expanding reamer for reclaiming the worn bushings in triple valve bodies

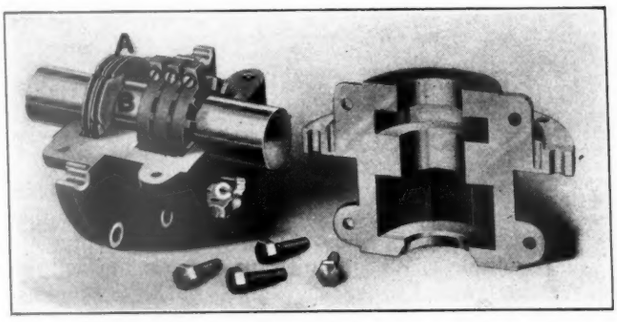
blades are expanded parallel to each other while inserted to the full depth of the bushing. This tool can be furnished by the Foster-Johnson Reamer Company, Elkhart, Ind., for almost all types of Westinghouse and New York triple valves.

Oil return wall plate metal packing

THE Garlock Packing Company, Palmyra, New York, has placed on the market a new type of metal packing which is known by the trade name of the Garlock oil return wall plate metal packing for gas and air compressors. It is designed to wipe all oil from the compressor piston rod and return it freely to the crank case. In addition to the oil wiper feature this packing is designed so that it will take care of the vacuum and low pressure on certain types of power cylinders.

The packing is furnished in either a split or solid case which is bolted to the partition wall plate after the stuffing box is removed. The mechanical details of the

packing are shown in the illustration. The pressure-vacuum ring which faces the cylinder side of the wall plate is shown at *A*. At *B* are shown three types of oil

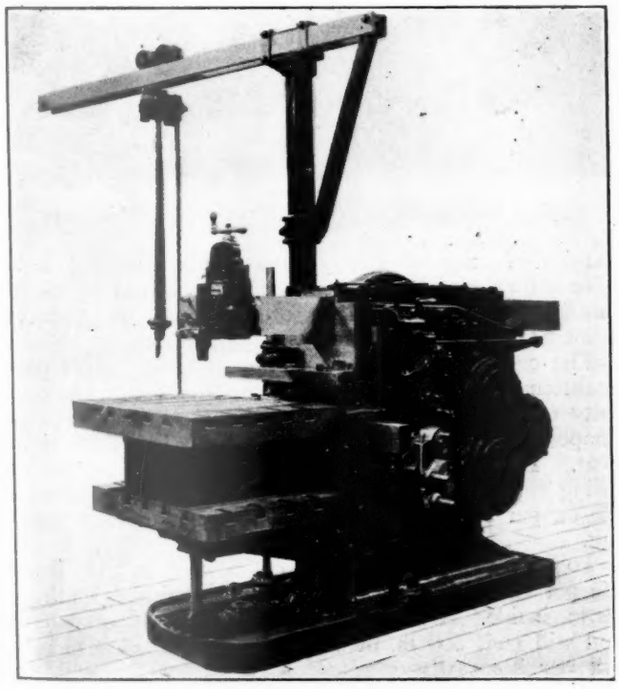


The Garlock oil return wall plate metal packing for gas and air compressors

wiper rings. The holes in the bottom half of the split case through which the oil returns to the crank case are shown at *C*.

Morton 36-in. stroke draw-cut shaper

THE heavy duty draw-cut shaper manufactured by the Morton Manufacturing Company, Muskegon Heights, Mich., has a cutting stroke of 36 in. It has 21 in. of vertical feed and 48 in. of horizontal feed on the crossrail. The crossrail can be extended to give 56



Morton 36-in. draw-cut shaper showing the auxiliary top table on the knee

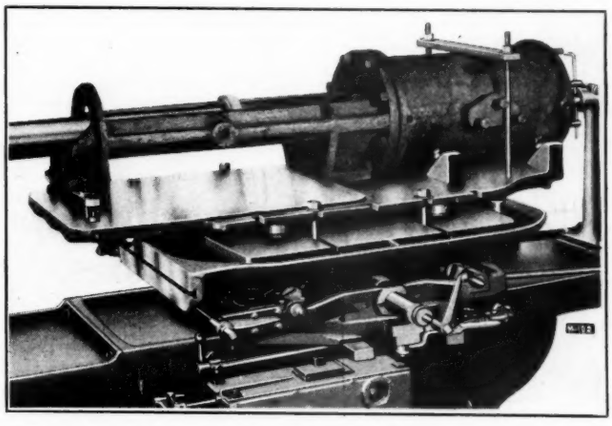
in. of horizontal feed, if desired. All the feeds are automatic and can be changed while the machine is in operation. The crossrail is now raised and lowered by three adjustable screws.

The clutches and other important parts of the shaper are automatically oiled. The shaper does the cutting on the draw stroke, thereby drawing the cutting strains against the column of the machine. An adjustable back bearing transfers the cutting strains to the column.

The machine will take the various Morton attachments for railroad work, except the attachment for slotting driving boxes. The machine can be furnished either with a belt or motor drive. It is equipped with an adjustable back bearing, auxiliary table, large tee-slotted table, swivel base vise, jib crane with a two-speed hoist and a set of O.K. tools and holders.

Mounting fixture for grinding reverse gear cylinders

THE Micro Machine Company, Bettendorf, Iowa, has designed a fixture and spindle which can be used on the swivel table of the Model F. G. Micro internal grinder for the grinding of all known types of reverse gear cylinders. This fixture has been designed for rapid set-up and permits the mounting of



With this fixture both the reverse cylinder and the circular guide may be ground in alinement without the need for disassembling

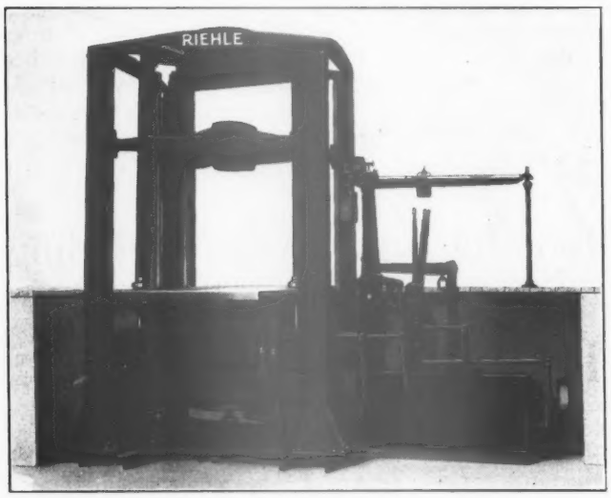
all types of reverse cylinders not exceeding 30½ in. long; also cylinders with circular guides attached not exceeding an overall length of 59½ in. Both the reverse cylinder and the circular guide may be ground in alinement without the need for disassembling. As soon as the cylinder has been ground, the table is swiveled and the circular guide is then ground in alinement with the reverse cylinder.

Riehle 1,000,000-lb. testing machine

THE illustration shows a 1,000,000-lb., three rotating reversed screw type of testing machine, built by the Riehle Bros. Testing Machine Company, 1424 North Ninth street, Philadelphia, Pa., two of which are now in use for the testing of large side frames and bolsters. The machine will take round specimens in tensile tests up to 7 in. in diameter, square up to 5 in. and flat specimens up to 5 in. by 7 in. For transverse tests it will take specimens up to 12 ft. long and 6 ft.

1½ in. wide and for compression tests the specimens may be 8 ft. long.

The maximum height, length and width of the machine are 28 ft. 8¾ in., 21 ft. ⅜ in., and 12 ft. 6 in.,

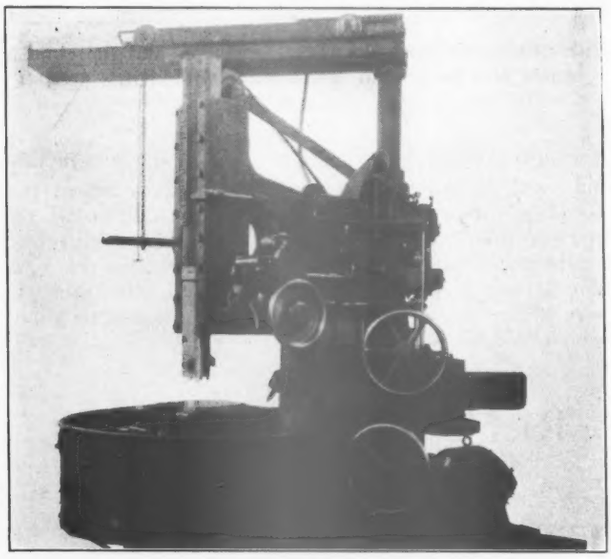


Riehle 1,000,000-lb., three rotating reversed screw type testing machine

respectively. The distance between the screws is 6 ft. 2 in. Twenty-five horsepower is required to pull up to capacity at the rate of 2 in. per min.

Boring and facing machine for locomotive driving boxes

SINCE describing the boring and facing machine for locomotive driving boxes manufactured by William Sellers & Company, Inc., 1600 Hamilton street, Phila-

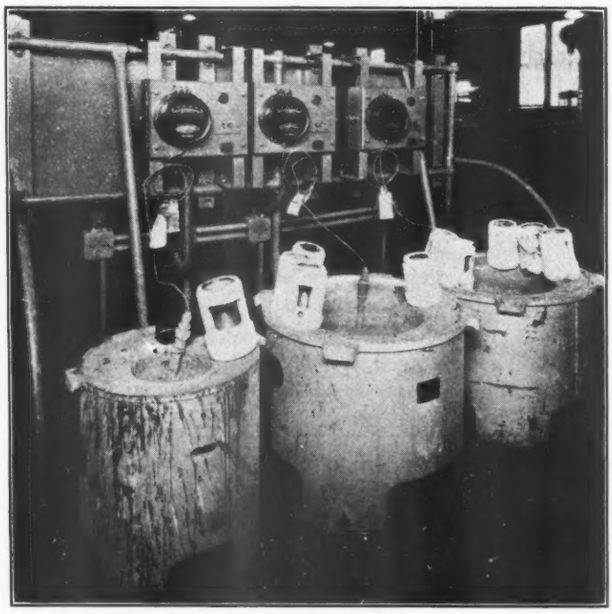


A central oiling system has been installed in the Sellers driving box boring and facing machine

delphia, Pa., on page 379 in the June, 1924, issue of the *Railway Mechanical Engineer*, several improvements have been incorporated in its design. The machine is now provided with quick power traverse operated by an independent motor for the vertical slide carrying the boring bar. The machine is also equipped with a central multiple oiling system. A pneumatic crane is also furnished for handling the boxes into and out of the machine.

Babbitt pots with corrosion resisting vessels

ELECTRICALLY heated pots for melting babbitt or solder in railway shops now have vessels that are corrosion resisting, which greatly lengthens the life of the equipment. These melting pots, manufactured by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., were built according to suggestions received from many engineers and master me-



Typical installation of corrosion resisting babbitt pots

chanics of various railway companies. Practical tests have shown that longer life is being obtained by using this high heat resisting alloy for the vessel. It produces a fine grained casting, free from pin holes.

The control of the temperature in these babbit pots is automatic. The mercury-actuated thermostat, the contacts of which may be adjusted over a wide range of temperature, keeps the molten metal at exactly the right heat. This relieves the workmen of the necessity of losing time in controlling the heat input and eliminates the danger of too cold or overheated metal when pouring.

To accommodate the large ladles used in car shops, the pot has a large diameter—16 in.—with a depth of 10 in. inside. It is designed to hold 500 lb. of babbitt and will melt 300 lb. of 50-50 solder or lead base babbitt per hour. It operates on 600 volts d.c. with an electrical capacity of 14 kw., requiring 6.3 kw. to maintain the molten metal at 900 deg. F.

WRENCHES.—A numerical index of standard wrenches is contained in the 20th edition of the Williams wrench catalogue issued by J. H. Williams & Co., Buffalo, N. Y. The "Superench" break-proof wrenches of chrome molybdenum steel are for the first time described in this catalogues.

News of the Month

A FIRE at the Allegheny shops of the Baltimore & Ohio at Pittsburgh, Pa., on April 26, damaged the blacksmith shop, sawmill and roundhouse; estimated total damage, $100,000 or more.

L. M. BETTS, manager of the closed car section of the Car Service Division of the American Railway Association has addressed a circular letter to the railroads in which he says that box cars, suitable for transporting grain and food products, are used too much for carrying commodities which make the cars unfit for this high-class traffic. Mr. Betts says in part: The frequency with which good, clean cars are used for loading commodities that leave the floors and sides impregnated with oils, grease or offensive odors indicates the necessity for more effective instructions and closer supervision.

Miller medal award

At the recent annual dinner of the American Welding Society, President F. M. Farmer announced the donation of an award, the gift of Samuel Wylie Miller, to be presented by the society annually in appreciation of work of outstanding merit in advancing the art and science of welding. The award is a gold medal, which will be known as the Miller medal. Mr. Miller is consulting engineer of the Union Carbide and Carbon Research Laboratories and a past president of the American Welding Society.

Wage statistics for February

The summary of reports of employees, service, and compensation filed by Class I railways with the Interstate Commerce Commission for the month of February, 1927, shows a decrease in the number of employees of 3,723, or 0.2 per cent, as compared with the returns for the preceding month. The total as of the middle of the month was 1,720,520. The total compensation, $228,171,570, shows a decrease of 6.7 per cent, which resulted principally from the fact that February had 23 working days, while January had 25. Compared with the returns for February, 1926, the number of employees shows a decrease of 0.7 per cent, and the total compensation an increase of 0.2 per cent.

New York Central places equipment orders

The New York Central Lines have bought 60 Hudson type heavy passenger locomotives from the American Locomotive Company. An experimental locomotive of this type was delivered some months ago, since which time it has been thoroughly tested in service with the aid of the dynamometer car. A description of these locomotives was published in the March issue of the *Railway Mechanical Engineer*, page 1390. The experimental locomotive has so satisfactorily met the requirements, both in regard to power and to efficiency, that the New York Central has now purchased 59 additional locomotives of this type.

The locomotive and tender, in working order, weigh 610,000 lb. The tender carries 24 tons of coal and 12,500 gallons of water. Of these locomotives 50 will be assigned to the New York Central and ten to the Michigan Central.

The New York Central has also placed orders for 3,500 freight cars, 175 passenger train cars and 55 locomotive tenders.

Meetings and Conventions

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad Clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, acting secretary, 165 Broadway. New York.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION DIVISION V.— MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 7, 8 and 9, Hotel Windsor, Montreal.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention, Chicago, August 31, September 1 and 2.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATMENT.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting, Hotel Sherman, Chicago, October 25-28.

BIRMINGHAM CAR FOREMEN AND CAR INSPECTORS' ASSOCIATION.—P. H. Gillean, 715 South Eightieth Place, Birmingham, Ala. Meeting, second Monday in each month at Birmingham, Y. M. C. A. Building.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. D. Wiegmar, 720 North 23rd St., E. St. Louis, Ill. Regular meeting first Tuesday in each month, except June, July and August.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Thursday each month, except June, July and August at Hotel Statler, Buffalo.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—(See Railway Car Department Officers' Association.)

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 811 Union Central Building. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month, except July, August and September at Hotel Hollenden, East Sixth and Superior Ave., Cleveland.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting, Hotel Lafayette, Buffalo, N. Y., August 16-18, 1927.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant Railway Exchange, 80 E. Jackson Boulevard, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn. Annual convention Chicago, September 6-9, 1927.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, New Orleans, La. Meeting third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—A. S. Sternberg, Belt railway. Clearing Station, Chicago. Annual convention Hotel Sherman, Chicago, August 23, 24 and 25.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meeting third Thursday in January, March, May, July, September and November.

TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings first Tuesday in each month, Terminal Hotel bldg., Fort Worth, Tex.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago, September, 1927.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The Crosby Steam Gage & Valve Company has moved its Chicago offices to 547 West Randolph street.

The Regan Safety Devices Company has closed its Chicago office and is now handling business from New York.

J. de N. Macomb has been appointed assistant to the vice-president, in charge of railroad sales of the Inland Steel Company, Chicago.

The National Pneumatic Company, Inc., has removed its New York office from 50 Church street to the Graybar building, 420 Lexington avenue.

The Davis Brake Beam Company, Johnstown, Pa., has moved its Pittsburgh, Pa., office from 427 Oliver building to its own building at 418 Sixth avenue.

The Bird-Archer Company has removed its offices from 33 Rector street to the Corn Exchange Bank building, 1 East Forty-second street, New York City.

The National Railway Appliance Company has removed its office from 452 Lexington avenue to the Graybar building, 420 Lexington avenue, New York City.

Arthur C. Langston has retired as an active representative of Jenkins Brothers, New York. Mr. Langston has been associated with Jenkins Brothers for about thirty years.

John A. Coakley, assistant to the vice-president of the American Steel & Wire Company, has been appointed general traffic manager, with headquarters at Cleveland, Ohio.

The Harnischfeger Corporation, Milwaukee, Wis., has opened an office at 1402 Lexington building, Baltimore, Md., in charge of Daniel J. Murphy, formerly manager at Dallas, Tex.

Charles A. Fisher, vice-president of the Jones & Laughlin Steel Corporation, has been elected president, with headquarters at Pittsburgh, Pa., to succeed the late W. Larimer Jones.

The Youngstown Sheet & Tube Company and the Youngstown Steel Products Company, Youngstown, Ohio, have moved their district sales office to suite 214-220 Continental Oil building, Denver, Colo.

Harrison W. Wood has joined the service staff of the Quigley Furnace Specialties Company, Inc., of New York. Mr. Wood's territory will include the central south and south Atlantic states. His headquarters will be at Atlanta, Ga.

Charles Chandler, assistant engineer of bridges of the Illinois Central, has resigned and has become associated with the J. G. Brill Company, Philadelphia, Pa., as salesman in the automotive car division, with territory in southeastern United States.

Brazelton, Wessendorff & Nelms, Inc., 317 Preston avenue, Houston, Tex., have been appointed sales agents for the Whiting Corporation, Harvey, Ill., to handle the Whiting line of cranes, foundry equipment and railroad specialties in southeastern Texas.

The Pittsburgh Testing Laboratory, Pittsburgh, Pa., has opened a new inspection headquarters and physical testing laboratory at Youngstown, Ohio, in charge of H. L. Christman, who has been identified with the testing and inspection profession for more than twenty years.

Frederick H. Thatcher, eastern district sales manager of the Worthington Pump & Machinery Corporation, New York, died suddenly on May 2 at Cincinnati, Ohio. Mr. Thatcher was born in New Canaan, Conn., and was a graduate of Cornell, class of 1895, in mechanical engineering. He was with the Worthington company and its predecessors for thirty years.

The Wood Conversion Company, Cloquet, Minn., has moved its Chicago office to 360 North Michigan avenue. This company expects to complete the construction of a Balsam-Wool factory, 380 ft. by 70 ft., adjacent to the present plant at Cloquet, Minn., by March, 1928. It will consist of two stories and a basement and will produce 600,000 sq. ft. of Balsam-Wool in 20 hours.

Frederick Weston, of the manufacturing department of the Baldwin Locomotive Works at Philadelphia, Pa., and formerly in charge of its New York office, died in Wynwood near Philadelphia, Pa., on April 17, at the age of 49. Mr. Weston graduated from Yale University with the class of 1900 and had been associated with the Baldwin Locomotive Works since his graduation.

Warren S. Abel, purchasing agent of the Yale & Towne Manufacturing Company, Stamford, Conn., died on May 14, at Stamford. Mr. Abel was born at Bozrah, Conn., on October 25, 1863. After the completion of a course at the Eastman Business College at Poughkeepsie and experience in the textile business at Norwich, Conn., Mr. Abel entered the service of Yale & Towne in 1891. In 1898 he was promoted to purchasing agent.

The Railway Steel Spring Company, New York, has closed its office in Norfolk, Va. The business of this district is now handled by Ross Anderson, district sales manager for the American Locomotive Company at Richmond, Va. Mr. Anderson will take over the Spring Company's business which for many years had been handled by H. C. Macklin, at Norfolk, Va. The business of the combined companies will be handled from Mr. Anderson's present address in Richmond, Va.

R. A. Davidson, western district sales manager of the Lincoln Electric Company, Cleveland, Ohio, with headquarters at Chicago, has resigned to become representative in the machinery department of Joseph T. Ryerson & Son, with headquarters at St. Louis, Mo. Royal D. Malm, who has had charge of sales in the automotive industries of the Lincoln Electric Company, with headquarters at Detroit, has been promoted to western district sales manager, with headquarters at Chicago, to succeed Mr. Davidson.

Leon P. Feustman, for many years vice-president of the Worthington Pump and Machinery Corporation, New York, died on April 7 at his home in New York City, at the age of 66. Mr. Feustman was born in Philadelphia, Pa., on May 6, 1861. He was graduated from the University of Pennsylvania in 1882 with the degree of B.Sc. In 1888, Mr. Feustman went to Mexico for the Consolidated Smelting & Refining Company and later was resident manager of all that company's affairs in Mexico. In 1900 he went to New York to serve in the home office of the company. For the following three years he was closely connected with some of the important Guggenheim enterprises, and left that organization in 1903 to become vice-president of the Power & Mining Machinery Company. Four years later he was elected vice-president and general manager of the International Steam Pump Company with which the Power & Mining Machinery Company was merged, and which through a reorganization in 1914 became known as the Worthington Pump and Machinery Corporation, Mr. Feustman serving with the latter company as vice-president until he retired a short time before his death.

L. P. Feustman

J. P. Alexander, manager of the New Haven, Conn., branch office of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed Boston manager in charge of all sales and service in New England, with headquarters at Boston, Mass. Mr. Alexander has been associated with the Westinghouse company for twenty years. George H. Cox, New England manager for the past eight years, has been appointed sales manager at the South Philadelphia Westinghouse Works, in charge of the sales of all the products manufactured at that plant, including steam turbines, condensers, Diesel engines, etc. The Westinghouse Electric & Manufacturing Company on April 26

opened its new Westinghouse building at 267 North Pennsylvania avenue, Wilkes-Barre, Pa. The sales department, formerly in the Miners Bank building, is now on the second floor of the new building and the entire first floor is occupied by the service shop, which is equipped with the latest design of tools and equipment.

The Prest-O-Lite Company, Inc., has sold the storage battery branch of its business to The Prest-O-Lite Storage Battery Corporation, a new company whose entire capital stock is owned by the Automotive Battery Corporation of New York. That portion of the Indianapolis plant of The Prest-O-Lite Company, Inc., used for the manufacture of storage batteries has been leased to the new company. The Prest-O-Lite Company, Inc., will continue the manufacture and sale of acetylene gas for use in the oxy-acetylene process of welding and cutting metals, automobile lighting, lead burning and similar industrial agencies.

William Goodman, vice-president in charge of manufacturing of the Worthington Pump and Machinery Corporation, New York, died in the Manhattan Eye, Ear and Throat Hospital in New York City on April 21. He was born in Cincinnati, O., 52 years ago. After graduating from Harvard in 1896, he entered the engineering department of the Laidlaw, Dunn, Gordon Company of Cincinnati, and, when that organization was absorbed by the Worthington Corporation, Mr. Goodman became general manager of the Cincinnati branch. He was transferred to New York in 1918 as assistant to the vice-president, and four years later was elected vice-president. Under the supervision of Mr. Goodman, the Worthington corporation's engineers developed the new double-acting Diesel engine which the United States Shipping Board adopted for some of its ships. The feather valve air compressors and other engineering devices were also developed under his direction. Mr. Goodman was on active duty in the Spanish-American War as an ensign in the Navy, and during the World War offered his services as an engineer and was placed in charge of the manufacturing of munitions at the Worthington plant, Hazleton, Pa.

W. Goodman

E. W. Davis, representative of the Westinghouse Air Brake Company, Boston, Mass., has been promoted to southwestern manager, with headquarters at St. Louis, Mo., and Raymond Boiselle, representative in the Pittsburgh district, has been transferred as representative to Boston, Mass., to succeed Mr. Davis. E. W. Davis was graduated from Purdue University with the mechanical engineering class of 1902. He served for several years with the Atchison, Topeka & Santa Fe, the Chicago, Burlington & Quincy and a number of industrial organizations, including the Westinghouse Automatic Steam Coupler Company. He entered the employ of the Westinghouse Air Brake Company in 1908 as inspector, and later served as assistant district engineer at New York. In 1919 he was appointed representative of the Westinghouse Traction Brake Company at the same place, and since 1922 served as representative at Boston. Raymond Boiselle received his mechanical engineering education at the University of Illinois. He served on the Missouri Pacific, the Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific. Entering the service of the Westinghouse Air Brake Company in 1912, he was employed in the test department until 1917. During the World War he served as first lieutenant and captain, Aerial Armament Division, overseas, returning to the Westinghouse service as mechanical expert in the southwestern district, where he remained until 1923, since which time he has been representative in the Pittsburgh district.

E. W. Davis

C. B. Woodworth has been appointed manager of the western division of the Vanadium Corporation of America, with headquarters in the Straus building, Chicago. Mr. Woodworth was graduated in mechanical engineering from Purdue University in 1907. From then until 1916 he served with the mechanical departments of the Wabash and the Baltimore & Ohio, passing through various grades from machinist to general foreman of the Mt. Clare shops of the Baltimore & Ohio. He then entered the employ of the American Arch Company, with whom he remained until 1918, when he was commissioned captain of engineers, U. S. Army. He served fifteen months with the A. E. F. on railroad work in France. Upon his return to this country he joined the foreign sales department of the American Locomotive Company, and spent six years in the Argentine and Brazil engaged in sales and service work. From 1926 until his present appointment he was with the Premier Staybolt Company as special technical representative.

Manning, Maxwell & Moore, Inc.

Manning, Maxwell & Moore, Inc., is engaged in an extensive program of development covering new and special machinery of various kinds as well as new devices of other characters, notably an entirely new form of gearing to be used for automobile differentials and other purposes. It has acquired the entire line of heavy machine tools formerly manufactured by the Detrick & Harvey Machine Company of Baltimore, and also the Beaman & Smith line of milling machines and special production machines for automotive and other operations, which line was formerly manufactured at Providence, R. I. It has taken over these lines completely, including good-will, patterns, drawings, etc., and will develop and produce them at the plant of the Putnam Machine Company, Fitchburg, Mass.

The program necessitates devoting its entire selling efforts and general resources to its own lines, and, therefore, it is discontinuing the sale of machine tools for other manufacturers with exceptions noted below. The branch offices at Birmingham, Philadelphia, Buffalo, Boston and Cleveland will be closed, but expert direct representatives will be located in those territories to conduct sales and service of Putnam tools including the new lines and developments, and products of the Shaw Crane plant.

The Chicago office will be continued as a department of Manning, Maxwell & Moore, Inc., under the management of R. S. Dean, and in that territory a selected line of machine tools will be handled in addition to products of the Putnam and Shaw plants.

In the Pittsburgh territory Norman Allderdice, formerly sales manager for Manning, Maxwell & Moore, Inc., has organized a machine selling company to be known as the Arch Machinery Company and arrangements have been made for that company to act as sales agents for products of the Putnam Machine Company and in certain areas products of the Shaw Crane Works.

Both manufacturing and sales operations of the Putnam and Shaw plants of Manning, Maxwell & Moore, Inc., will be under the executive direction of Frank J. Baumis, who is vice-president of Manning, Maxwell & Moore, Inc., and president of the Putnam Machine Company. Joseph Wainwright will be general sales manager of machinery sales, and W. B. Clark will be general sales manager of crane sales.

Manning, Maxwell & Moore, Inc., will continue to act as exclusive sales agents in the railroad trade for the Monarch Machine Tool Company and the Amplex Machinery Company.

The Ashcroft-Hancock-Consolidated, and other steam specialties manufacturing and sales activities of Manning, Maxwell & Moore, Inc., are in no way affected by these changes.

Personal Mention

General

J. C. Mengel, master mechanic of the Altoona, Pa., machine shops of the Pennsylvania, has been appointed assistant to the works manager.

John W. Griffiths has been appointed superintendent of motive power of the Guantanamo Western, with headquarters at Guantanamo, Cuba.

William Landess, chief electrician in charge of electrical maintenance of the Chicago Union Station Company at Chicago, has been promoted to assistant mechanical superintendent with supervision over all mechanical and electrical matters.

C. B. Smith, who has been appointed engineer of tests of the Boston & Maine, with headquarters at Billerica shops, North Billerica, Mass., was born on November 28, 1867, at Montgomery, Vt. He attended Colgate Academy, Hamilton, N. Y., and was graduated in mechanical engineering from Worcester Polytechnic Institute in 1888. He entered railroad service in 1895 as assistant chief draftsman for the Boston & Maine. Four years later he was appointed chief draftsman and, in 1901, became master mechanic of the Boston shops. He remained in this capacity until 1906, when he was appointed mechanical engineer, which position he held until January of the current year, when he was appointed assistant to the mechanical superintendent. This position he held at the time of his recent appointment as engineer of tests.

C. B. Smith

Master Mechanics and Road Foremen

Walter H. Ohnesorge, master mechanic of the Connecticut River, White Mountains and Passenger divisions of the Boston & Maine at Springfield, Mass., has been appointed master mechanic of the Fitchburg-Berkshire division, with headquarters at East Deerfield, Mass. Mr. Ohnesorge was born on July 12, 1885, at Dubuque, Ia. He entered the employ of the Chicago, Milwaukee & St. Paul at Dubuque in April, 1902, as a machinist apprentice. He completed his apprenticeship in 1906 and after working at various places on different railroads, returned to the C. M. & St. P. as a machinist in 1908. In 1917, after serving as a machinist at McGregor, Ia., Miles City, Mont., and Seattle, Wash., he was appointed roundhouse foreman at Othello, Wash. In June, 1920, he was appointed general foreman in charge of locomotive shops and enginehouse at Miles City, and in January, 1922, transferred to shops at Austin, Minn. In January, 1924, he became general foreman of the Western Maryland at Cumberland, Md.; in August, 1925, enginehouse foreman of the Boston & Maine at Westboro, N. H.; in March, 1926, general foreman in charge of shops at Mechanicsville, N. Y., and in February of this year, master mechanic at Springfield.

W. H. Ohnesorge

O. N. Edmondson, general foreman of the Juniata erecting and machine shops, has been appointed master mechanic of the Altoona, Pa., machine shops of the Pennsylvania, succeeding J. C. Mengel.

Shop and Engine House

J. B. Harward has been appointed general foreman of the Baltimore & Ohio, with headquarters at New Castle, Pa.

O. Bennett has been promoted to night boilermaker foreman of the Baltimore & Ohio, with headquarters at Willard, Ohio.

G. A. Wyman, superintendent of the Concord, Mass., shop of the Boston & Maine, has retired after 43 years' service on that road. Mr. Wyman started in the mechanical department of the B. & M. at Boston in 1884. He served as fireman on the Portland division; traveling engineer on the Southern division, and general air brake inspector. In 1913 he went to Concord as master mechanic of the Southern division, and in 1915 was appointed shop superintendent. Mr. Wyman is 62 years old.

Car Department

E. M. Jenkins, chief draftsman, car department, of the Delaware, Lackawanna & Western, has been appointed master car builder with headquarters at Scranton, Pa., succeeding P. Alquist, deceased.

Purchases and Stores

E. A. Workman, stores manager of the Central of New Jersey at New York, has been appointed manager of purchases and stores of the recently consolidated purchasing and stores department. C. B. Williams, purchasing agent at New York, has been granted an extended leave of absence on account of ill-health.

Obituary

S. P. Alquist, master car builder of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa., died suddenly on May 4 on a Michigan Central train while en route to Grand Rapids, Mich. The death was due to heart trouble, following an extended attack of grippe. Mr. Alquist was born on May 10, 1874, in Sweden. He was educated in the grade schools and Y. M. C. A. night schools. His first work for a railroad was with the Illinois Central as car repairer at Memphis, Tenn., in which service he began on February 4, 1895. Following that he was interchange inspector for that road from 1897 to 1900. He then became assistant general foreman of car repairs, a position he held until 1905, when he was appointed district general foreman. In 1910 he was appointed general foreman of the car department of the Cincinnati, Dayton & Hamilton, and in November, 1911, he was appointed general foreman and chief inspector of the car department of the Pere Marquette. He left that road to become superintendent of the car department of the Missouri-Kansas-Texas, returning to the Pere Marquette in 1917 as master car builder, a position he held until he was appointed master car builder of the Delaware, Lackawanna in July, 1924. He held that position until the time of his death.

P. Alquist